PART I - THE SCHEDULE

SECTION C - DESCRIPTION/SPECIFICATION/WORK STATEMENT

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STATEMENT OF WORK (GRC 52.211-106) (JULY 2014)

C.1 INTRODUCTION

The NASA Glenn Research Center (GRC) encompasses of two sites: Lewis Field (LF) in Cleveland, Ohio and Plum Brook Station (PBS) in Sandusky, Ohio. The majority of the services required under this solicitation are for the GRC LF campus, but there are selected services required at GRC PBS as well.

GRC LF is comprised of 298 acres and includes 79 active buildings and 92 structures and systems (electrical substations, cooling towers, underground utilities, etc.). The buildings on the Center enclose a total of 2.25 million square feet of floor area which consists of Propulsion & Aerospace R&D Test Facilities (63%), Administrative Offices (27%) and Warehouse/Storage/Shop Area (10%). Currently, 70% of these facilities are 60 years old or greater.

GRC PBS is comprised of 6,377 acres and includes 130 active buildings and 39 structures and systems. The buildings on the Center enclose a total of 584,000 square feet of floor area which consists of Propulsion and Aerospace R&D Test Facilities (42%), Administrative Offices (14%) and Warehouse/Storage/Shop Area (44%).

This solicitation is for a cost plus, fixed fee contract. The Contractor shall provide the following services located at Lewis Field; (1) the operation, maintenance and repair of the Central Process Systems (CPS) equipment, (2) the maintenance and repair of High Voltage Electrical Substations control equipment, (3) the maintenance and repair of Cryogenic Systems, and (4) the certification services for all Pressurized Vessels & Systems. At Plum Brook, the Contractor shall provide the following services (1) the maintenance and repair of Cryogenic Systems, and (2) the certification services for all Pressurized Vessels & Systems. Historic workload data for theses required services is provided in Attachment J-C-1.

This Statement of Work (SOW) is structured to show overall contract management and business requirements in Chapters C.1 through C.7, and the technical requirements in Chapters C.7 through C.14. Attachment J-C-1b, GRC Lewis Field Real Property List and Attachment J-C-1a, GRC Plum Brook Station Real Property List describe the buildings, structures and systems that will require services offered under contract.

C.2 SCOPE OF WORK AND SYSTEMS OVERVIEW

C-2.1 General. The Contractor shall furnish all management, labor, supervision, tools, materials, equipment, and transportation necessary to address all elements outlined within this SOW.

C-2.1.1 Latest version of NASA Policy Requirement NPR 8831.2 *Facilities Maintenance and Operations Management* is as an advisory document for all maintenance and repair services identified in this SOW. See link: (http://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPR&c=8831&s=2E)

C-2.1.2 Latest versions of NASA Policy Directive NPD 8710.5 *Policy for Pressure Vessels and Pressurized Systems*, (http://nodis3.gsfc.nasa.gov/displayDir.cfm?Internal_ID=N_PD_8710_005D_&page_name=main), and NASA Standard NASA-STD-8719.17 *NASA Requirements for Ground-Based Pressure Vessels & Pressurized Systems (PVS), (*http://www.hq.nasa.gov/office/codeq/doctree/871917.pdf*)* is as an advisory document for all Certification services identified in the SOW.

C-2.2 Work Scopes. This contract consists of a Base Work Scope and an Indefinite Delivery, Indefinite Quantity (IDIQ) Work Scope.

C-2.2.1.1 Base Work Scope. The Base Work Scope for this contract consists of the following:

C-2.2.1.1 Contract Management (including program management, business functions, work control functions, safety, health & environmental functions, etc.) for both the Base & IDIQ Work Scopes.
C-2.2.1.2 Minor Repairs, Maintenance and Operations of the GRC LF Central Process Systems.
C-2.2.1.3 Minor Repairs, Maintenance, Operation and design modifications for the GRC LF & PBS Cryogenic Systems.
C-2.2.1.4 Minor Repairs, Maintenance of the GRC LF High Voltage Electrical System Controls.
C-2.2.1.5 Certification services for the GRC LF & PBS Pressurized Vessels & Systems.
C-2.2.1.6 Minor Design modifications and analysis for the GRC LF & PBS Pressurized Vessels & Systems.
C-2.2.1.7 All technical staff to support the functions listed above.

C-2.2.2 IDIQ Work Scope. The IDIQ Work Scope for this contract consists of the following:

C-2.2.2.1 Major Repairs and Upgrades to the GRC LF Central Process Systems.
C-2.2.1.2 Major Repairs and design for the GRC LF & PBS Cryogenic Systems.
C-2.2.1.3 Major Repairs and Upgrades to the GRC LF High Voltage Electrical System Controls systems.
C-2.2.1.4 Major finite element analysis, flexibility analysis and design for hardware modifications for the GRC LF & PBS Pressurized Vessels & Systems.
C-2.2.1.5 All technical staff to support the functions listed above.

C-2.3 Central Process Systems (CPS) Operations, Maintenance & Repair. The GRC LF Central Process Systems (CPS) consists of a series of critical research utilities that support aerospace ground test facilities throughout the campus. Many of these aerospace test facilities conduct "real time" testing of air-breathing engines, rocket engine components and other related systems. To replicate the conditions encountered in flight such as high speed and/or high altitudes, GRC utilizes very large centralized compressed air system (called the Combustion Air System) and a large centralized vacuum system (called

the Altitude Exhaust System). In addition, these systems require a multitude of subsystems to heat, cool, or dry air as required for specific tests.

Most of the GRC LF CPS equipment and subsystems are located in the Central Air Equipment Building No. 64 or in the Engine Research Building (ERB) Complex which consists of Building Nos. 5, 23, 37 and 38. Large overhead piping delivers the Combustion Air or Altitude Exhaust to various aerospace ground test facilities located throughout the Central Campus of GRC LF. Control of equipment and dispatching services are provided from control rooms located in B143, B64 and B5. For a completed list of buildings that house CPS equipment see Attachment J-C-2.3.

The CPS consists of the following systems and subsystems:

C-2. 3.1 Combustion Air (CA) System. To simulate speed, large electric motor driven compressors produce pressurized air ranging from 40 to 1250 psig. Typically, air at ambient conditions is gradually raised in pressure, using staged compressor systems, in increments from 40 psig, 150 psig, 450 psig and 1250 psig. Each stage includes equipment to cool, heat or dry the air as required for specific test conditions. Maintenance, repair and upgrade implementation of the Combustion Air System and the interface to the Central Process Systems Distributed Control (CPSDC) is part of the work scope of this contract.

C-2. 3.2 Altitude Exhaust System. To simulate high altitude conditions, large electric motor-driven compressors (typically called "exhausters") create conditions that simulate altitudes up to 90,000 feet above sea level. Much like the Combustion Air System, the Altitude Exhaust System is staged, and each stage requires subsystems to cool the air. Maintenance, repair and upgrade implementation of the Exhaust System and the interface to the Central Process Systems Distributed Control (CPSDC) is part of the work scope of this contract.

C-2. 3.3 Service Air (SA) . The Service Air System provides a center-wide continuous supply of clean, dry 125 psig compressed air. Three Ingersoll-Rand PRE compressors (SA20, SA21 and SA22) located in the basement of the Engine Research Building (Building 5) serve as a primary source of compressed air. A fourth identical compressor (SA23) located in the Special Projects Laboratory (Building 24). A new fifth Centrifugal compressor (SA24) will be installed in 2016 which will be located in Central Air Equipment Building (Building 64) will serve as an additional source of 125 psig compressed service air. Once SA24 is operational, SA23 will be decommissioned. Maintenance, repair and upgrade implementation of the Service Air System and the interface to the Central Process Systems Distributed Control (CPSDC) is part of the work scope of this contract.

C-2. 3.4 Centralized Cooling Tower (CT) Water System. Cooling of CPS equipment and systems is accomplished using water from four (4) large cooling towers located on the Central Campus. Specifically, the Centralized Cooling Tower Water System includes Cooling Tower No. 1 (Property No. 10), Cooling Tower No. 3 (Property No. 70), Cooling Tower No. 4 (Property No. 82), Cooling Tower No. 5 (Property No. 93), and Cooling Tower No. 6 (Property No. 126). Maintenance, repair and upgrade implementation of the Cooling Tower System and the interface to the Central Process Systems Distributed Control (CPSDC) is part of the work scope of this contract.

C-2. 3.5 Variable Frequency (VF) Electrical Power System. The Variable Frequency Electrical Power System at the Engine Research Building West Wing (Building 23 basement) is an electrical power supply that is connected to various test cells (W1, W7, W8, CE18). The output frequency is adjustable from 10 to 120 cycles per second (Hz) with voltage proportional to frequency (54 V/Hz). It can deliver or absorb power to the full rating of the equipment. Complete flexibility of set-up and operation is obtained through paralleling and switching of converter combinations to the ring bus

switchgear. Maintenance, repair and upgrade implementation of the Variable Frequency System and the interface to the Central Process Systems Distributed Control (CPSDC) is part of the work scope of this contract.

C-2. 3.6 Central Process System Distributed Control (CPSDC). The Central Process System Distributed Control uses remote processors and programmable logic controllers communicating via thirteen miles of coaxial data highway cable to operator workstations in Buildings 143, 64, 23 and 5. The remote processors and programmable logic controllers (with over 14,000 I/O points) are used for control and data acquisition of equipment in the areas of Electrical Power Dispatch, Central Air Dispatch, Engine Research Building (ERB) and Central Air Equipment Building (CAEB) and The Variable Frequency Power facility (VF). This equipment includes Compressors, Exhausters, Dehydrators, Chillers, Cooling Towers, Valves, Substations, Uninterruptible Power Systems (UPS), Electrical Motors, and Generators for backup power and variable frequency power generation. The CPSDC Data Archive system provides historical data for all 14,000 data points. Data playback format can be in graphic trend or operator process screen playback. All data from Feb. 7, 1999 is available on line for recall and playback. Standard time resolution of data is one second but 100 msec playback is available for particular Sequence of Event information. Maintenance, repair and upgrade implementation of the Control System are part of the work scope of this contract.

C-2. 3.7 Central Air Distribution (CAD) System. The CAD system encompasses five CPS services; Combustion Air, Service Air, Refrigerated Air, Altitude Exhaust and Atmospheric Exhaust. The distribution system routes airflows at different pressures to the various test facilities located within Lewis Field and is comprised of over 9 miles of piping, 730 remotely controlled valves, and a multitude pressure relief and monitoring devices. Historically operations of the CAD systems were performed within the Central Control Building. The Contractor shall be responsible for providing CAD systems dispatching operations; operations consist of dealing with the various researchers to determine the daily equipment requirements and schedule, directing equipment operators in setting up equipment and systems configurations, and routing the air services to the customers. The maintenance of these equipment is part of this contract as well.

C-2.4 Cryogenic & High Pressure Gas Systems Operations, Maintenance & Repair. The Cryogenic Systems include various high pressure gases and cryogenic liquids including: air, methane, nitrogen, hydrogen, oxygen, helium and argon mediums. These mediums are delivered to GRC LF & PBS by outside vendors and stored in stationary or mobile pressure vessels and cryogenic Dewars. Cryogenics may be used in the liquid form or transformed into high pressure gases through vaporizers\cryo pumps for research applications. Mobile equipment includes approximately: 32 Tube Trailers, 19 Dewar and 6 Liquid Vaporizers. Stationary equipment include approximately: 21 Dewars, 35 High Pressure Vessel locations, 22 mobile Liquid Vaporizer Connections, 28 Tube Trailer Connections, 38 Distributed Systems and 71 non-Distributed Systems. The scope of work for cryogenic systems includes maintenance, operations, and engineering.

C-2.5 High Voltage Electrical Substation Control Maintenance & Repair. High voltage electrical power for both institutional and research testing needs is supplied to GRC LF through four (4) 138 kV lines from First Energy to GRC Substation A, Property No. 200. This power is subsequently routed through underground concrete duct banks* to twelve (12) additional Substations located throughout the Center. Maintenance, repair and upgrade implementation of the substation controls and the interface to the Central Process Systems Distributed Control (CPSDC) is part of the work scope of this contract.

*NOTE: Above ground electrical power lines are routed on poles between Substation A and Substation N.

C-2.6 Pressurized Vessels & Systems (PVS) Certification. In addition to Central Process Systems, various gases and cryogenic liquids including nitrogen, hydrogen, oxygen, helium and argon are delivered to GRC LF & PBS by outside vendors and stored in pressure vessels and cryogenic dewars. Complex piping systems distribute these gases and cryogenic fluids to various test cells and research facilities. These pressure vessels and piping systems must be regularly certified to various National Consensus Codes and Standards (NCS) such as ASME Boiler and Pressure Vessel Code, ASME B31 series Piping Codes, NFPA fire codes, CGA guidelines, and API recommended practices. The certification process requires regular In-Service Inspection (ISI) of PVS by qualified personnel, engineering analysis to assess remaining life, and formal documentation. A formal Pressure Systems Database (PSD) is maintained under this Contract. Associated repairs necessary to bring PVS into code compliance are also within the scope of this contract.

The GRC certification program includes roughly 1,400 systems (with over 30,000 associated components), 1,100 pressure vessels, 140 Dewars, 200 heat exchangers, 5,000 relief devices, and 2,200 Flex Hoses. These system convey over 50 different commodities such as air, cryogens (LOX, LH2, LCH4, inerts), fuels, water, steam, Freon, and toxics (Ammonia, Hydrogen Chloride, Silane, Propane, Oxygen, Nitrous Oxide, etc.). Pressurized systems include wind tunnels, vacuum vessels, dryers, dehydrators, coolers, filters, separators, piping and other components. Required inspection, certification, maintenance, and repair of these vessels, piping and components are included in the scope of this contract.

This Contractor is responsible for certifying institutional systems at GRC LF & PBS as identified in Attachment J-C-2.6. A summary listing of systems and discrete components certified at time of this SOW draft is also provided in Attachment J-C-2.6a.

C-3. SPECIFIC ACTIVITIES NOT CONTAINED WITHIN THE SCOPE OF THIS CONTRACT

C-3.1 General. The functions listed below are not part of this Contract.

C-3.2 CPS Engineering. The Contractor shall not be responsible for providing any CPS engineering; all CPS engineering will be provided by the Facilities Division.

C-3.3 Institutional Responsibilities. The Contractor is not responsible for institutional systems, equipment or areas. Such institutional systems, equipment or areas would include, but not limited to, structural and cosmetic damage; leaking roofs; inoperable or backed up floor, toilet, and/or sink drains and plumbing; overfilled liquid reservoirs; leaking pipes; electrical or mechanical damage; fire or overheated equipment, area lighting, telephones, alarm systems, intercom systems and room temperatures.

C-3.4 Electrical Power Dispatching Operations. The maintenance and repair of substations and the underground cabling and the dispatching of electrical power throughout the Center is NOT part of the scope of work for this contract. The operation of breakers associated with the High Voltage Distribution Systems is also not part of this Contract.

C-3.5 Software Modifications. The Contractor shall not modify any software.

C-3.6 Cooling Tower (CT) Fire Protection and CT Water Treatment. CT Fire Protection and CT Water Treatment is NOT part of the scope of work for this contract.

C-3.7 Fuel Dispatching Services. Fuel dispatching, maintenance on fuel trailers, above and below fuel storage tanks, and fuel distribution systems are NOT part of the scope of work for this contract.

C-3.8 Excavation Services. Routine excavation services are NOT part of the scope of work for this contract. Any non-routine excavation shall be approved by the COR. The Government has another on-site Contractor that can be utilized for excavating.

C.4 GENERAL REQUIREMENTS, PRACTICES AND PROCEDURES

C.4.1 General. The following are general GRC requirements, practices and procedures that apply to all aspects of the work specified in this SOW.

C-4.2 CPS Engineering Requirements. The Contractor shall be responsible for notifying the COR and/or the appropriate Facilities Division's System Manager when they believe engineering services are required for troubleshooting. The Contractor shall notify the COR and/or the appropriate Facilities Division's System Manager of any system or components upgrade or modification they believe needs to be implemented that will enhance the performance of the CPS.

C-4.3 Institutional Requirements. The Contractor shall be responsible for immediately reporting to the COR and/or the Facilities Division Work Control Office any institutional type abnormalities they identify within any building or facility that contains CPS equipment or systems or in which they occupy.

C-4.4 Software Modifications. The Contractor shall notify the COR and the appropriate Systems Manager when they discover or believe a software modification should be made.

C-4.5 Work Schedules. The Contractor shall be fully cognizant of the NASA Research Facility Test/Central Process Systems Requirement Schedule, which is created by the Government, when planning any work activities. The Contractor shall ensure that there is non-tagged (LO/TO) equipment available to meet the needs and schedules of the research community. The Research Facility Test/Central Process Systems Requirement Schedule is published every Thursday by the Central Air Dispatchers and is normally available over the IDE network by 2:00 p.m. The schedule may be updated periodically throughout the week to reflect schedule changes. The Contractor shall develop a weekly manpower staffing chart per facility/discipline based on the schedule and manpower loading. Typical Schedule is given in Section J-C-4.5.

C-4.5.1 IDIQ Task Order Work Schedules. The Contractor shall provide to the COR a copy of any other work schedules (e.g. monthly, weekly) as requested in the IDIQ Task Orders. The Contractor shall notify the COR of any revisions or deviations to the published schedules and provide a revised copy.

C-4.5.2 System and Equipment Maintenance Shutdown (Annual Maintenance Shutdown) Work Schedule. Annual Maintenance Shutdowns historically range between two (2) weeks and nine (9) weeks depending on research activities, large capital repair/improvement projects, system upgrades or other factors. Another maintenance shutdown occurs near the Christmas / New Year timeframe, other minor shutdowns may occur at any time during the year. The Contractor shall develop a schedule detailing all the activities the Contractor plans to accomplish during the Annual Maintenance Shutdown or other minor shutdowns. The schedule shall be submitted to the COR for review. The schedule shall be submitted to the COR no later than the sixty (60) calendar days before the start of the Annual Maintenance Shutdown, and no later than fifteen (15) calendar days before the start of minor shutdowns. The schedule shall be divided into sections and identified, by building or area location, by work category, OCMR, PM, PGM, PT&I, IDIQ, I&R, and so forth. The schedule shall indicate all work to be accomplished by the negotiated completion dates. Deviations from the schedule must be approved by the COR.

C-4.6 Performance. The Contractor's work performance shall comply with the approved and accepted standards of the industry, equipment manufacturers, applicable local, state, federal standards and all applicable GRC NASA Policy Requirements (NPR), NASA Policy Directives (NPD) Safety, Health and Environmental policies.

C-4.6.1. Workmanship. The Contractor shall carry to completion all corrective, repair and replacement work including all operational checks and cleanup of the equipment and job site. The

Contractor shall ensure replacement work shall match previous work in dimensions, finish, color, and design unless otherwise specified by the Government.

C-4. 6.2 Cleanliness. The Contractor shall ensure that during the execution of work tasks, debris shall not be allowed to accumulate on the jobsite or spread into adjacent areas. The Contractor shall ensure that at the completion of a job, debris, excess material, and parts shall be cleaned up and removed from the job site and that any waste shall be placed in the appropriate containers in compliance with GRC Waste Management standards. The Contractor shall be responsible to maintain good housekeeping in all, equipment, electrical, mechanical areas and in storage areas they occupy or utilize.

C-4.7 Equipment Under Warranty. The Contractor shall not remove or replace any new equipment, components, and/or parts installed by other contractors that is found to still be under warranty by the manufacture or the installer without prior approval of the COR. All defects in material or workmanship, defective parts, or improper installation and adjustments found by the Contractor shall be reported to the COR so that necessary action may be taken. Available warranty information will be furnished to the Contractor by the COR or be indicated within the Maximo system (Contracts Module).

C-4.8 Configuration Management. The Contractor shall obtain Government approval prior to making configuration changes to any existing system. If deviations are identified from the approved documentation, the Contractor shall obtain government approval prior to implementation. All red-line documentation shall be returned to the COR for incorporation into the official records, maintained by the Facilities Configuration Control Office. In addition, the Contractor shall conform to the following configuration management requirements:

C-4.8.1 For CPS. The Contractor shall be responsible for providing red-lined drawings that capture changes. The red-lined drawings shall be transferred to the COR. A copy of the Red-lines shall be kept in the field until the As-Builds are returned to the Contractor for filing.

C-4.8.2 For non-CPS. The Contractor shall be responsible for creating as-built drawings from red-lined drawings via AutoCad that capture changes. The as-built drawings shall be transferred to ADEPT for signatures.

C-4.8.3 New Assets. If new Assets are added as a result of SR or ROI work, official Maximo asset numbers must be obtained from the COR. See Section J-C-4.8.3 for a further Asset information requirements.

C-4.8.4 Pressure Systems Database. The Contractor will be given access to the Pressure Systems Database (PSD) and will be charged with continually updating and maintaining accuracy of all data contained within. The PSD is web-based database operating on the Oracle platform. It is used to track Pressure Vessel and System data at both the component and system levels. Data maintained includes physical configuration data (component brand, make, model, size, and capacity information, etc.) as well as In-Service Inspection (ISI) status information. Maintaining an accurate PSD is considered a necessary and essential discipline of Configuration Management.

C-4.9. Access To Government Drawings & Records. The Contractor will have accesses to the roughly 120,000 facility record drawings managed by the GRC Configuration Control Office. This includes access to hard-copy stick files (located in Building No. 21) and access to the following database systems:

C-4.9.1 Adept (Synergis Software, a Division of Synergis Technologies, Inc.). The Contractor will be given read-only access to the GRC Adept system, which is used to help locate, manage, share,

and control native AutoCAD documents throughout their lifecycle. Adept integrates with AutoCAD data files and any CAD-related support files. Many Adept folders also contain PDF versions of operations & maintenance manuals, data sheets, and project information. Adept has been active at GRC since 2007, and is the official repository of controlled documents for GRC Lewis Field and Plum Brook Station.

C-4.9.2 Glenn Drawing Information System (GDIS). The Contractor will be given access to GDIS, which is a web-based database used to track and search for drawings and drawing-related items. Unlike Adept, GDIS cannot display or control native AutoCAD files (DWG files). GDIS can display PDF files of drawings and of stored Facility Change Requests (FCRs).

C.4.10 Area Clearance Process. The Contractor shall utilize the GRC Area Clearance process when work requires the interruption of a utility or service. This process ensures that the work can be accomplished in a safe manner and that there is adequate notification of the timing, duration and nature of the impact to building occupants and/or facilities. The GRC Area Clearance Procedure is provided in Attachment J-10, General Library and the Area Clearance Form, NASA Standard Form C-978, is provided in Attachment J-C-4.7.

C.4.11 Interfaces With Government Personnel and Other Government Contractors. The execution of the SOW will require this Contractor to interface with a wide variety of Government personnel and other Government contractor personnel. These interfaces are as follows:

C.4.11.1 Contracting Officer (CO). The CO is the only Government individual with the authority to enter into, administer, and/or terminate this contract and make related determinations and findings. The CO will be the Contractor's single POC for all invoices for completed work and changes to scope, schedule, or contract value. No other individual has the authority to make decisions on behalf of the Government regarding this contract.

C.4.11.2 Contracting Officer's Representative and Alternate (COR/ACOR). The COR acts as an advisor to the CO regarding technical, schedule, financial, and quality matters associated with the contract. The Contractor's Program Manager and Business Office personnel will have daily interactions with the COR regarding the status of on-going work and the financial aspects of the contract.

In the absence of the COR, the ACOR will assume the above duties.

C.4.11.3 Technical Representatives (TR). GRC's civil servant System Manager, Facility Manager or Facility Engineer responsible for Technical oversight of Contractor Performance. The Contractor's field technicians may have daily interactions with the TR on Technical issues.

C.4.11.3.1 Systems Managers (SMs). A SM is a senior-level civil servant engineer who provides management and oversight for operations, maintenance, and defines requirements for modifications and/or systems upgrades. The SMs are considered to be subject matter experts of their respective systems. Specifically, the SM is responsible for:

C.4.11.3.1.1 Defining equipment and system requirements
C.4.11.3.1.2 Establishing operating policies and procedures
C.4.11.3.1.3 Maintaining the system knowledge on system capability and capacity
C.4.11.3.1.4 Maintaining configuration control

In addition, the SM is responsible for approving Area Clearances for system outages, Facility Change Requests (FCR), Operational Safety Permits, and Dig Permits.

C.4.11.3.2 Facility Managers (FMs). The FM is senior-level civil servant engineer who provides management and oversight for test facility systems and equipment. The FMs are considered to be subject matter experts of their respective facility.

C.4.11.3.3 Facility Engineers (FEs). The FE is engineer who provides engineering and oversight for test facility systems and equipment.

C.4.11.5 Building Managers. The GRC Building Managers are responsible for overseeing and communicating all building related issues, which impact building occupants and/or stakeholders, to the appropriate entity or person for issue resolution. These responsibilities include capturing and tracking building related issues and facilitating a resolution with the appropriate SM, and the Institutional Facilities Maintenance contractor and/or the COR. The goal of a Building Manager is to foster cooperative relationships with building occupants and to ensure that building services are adequately maintained. Building Manager also accompany SHeD inspectors in performing safety inspections and walk-throughs. GRC has assigned a Building Manager for all of the "institutional" properties at GRC Lewis Field. The Contractor shall have Building Manager type responsibilities for all areas and building that are associated with the Central Process Systems and Cryogenic related buildings. See attachment J-C.4.8.5 for a list of all buildings and areas.

C.4.11.6 Safety & Mission Assurance Organization. The GRC Safety and Mission Assurance organization ensures that a safe, healthful, and protective environment is available for all GRC on-site personnel and contractors. This organization includes a Reliability and System Safety group, Occupational Health group (which includes the Chemical Management group), and an Operational Safety group.

Process System Safety Committee Chair (PSSC): At GRC, Lewis and PBS, all CPS operations are assessed and are under the jurisdiction of the PSSC. The PSSC, as well as other safety committees, conduct independent reviews of proposed operations in their assigned areas to ensure that the proposed operations are consistent with sound engineering principles and applicable safety and health requirements and standards. The PSSC Chair, with the support of committee members, confirms that all operational hazards and risks are identified, assessed, and sufficiently mitigated to acceptable levels. The Contractor submits to the PSSC, via the GRC electronic safety permit process, a safety permit request and supporting documentation to ensure this independent assessment takes place. Upon completion of the PSSC assessment, the PSSC Chair issues a safety permit, including conditions for conducting the activity. It is the responsibility of the Contractor to operate the equipment assigned under a prescribed safety permit. The permits are usually issued for one or two years. Sixty days prior to the expiration of the permit, the Contractor shall request a renewal request and supporting documentation with any changes since the last permit. The Contractor is not allowed operate any CPS equipment with an expired safety permit, unless approved and notified by the PSSC Chair in writing. No changes to the operations, design, alarms, or shutdowns can be made without the approval of the safety committee. Details of the Safety Permit process can be obtain in attachment J-C-4.11.6.

The following specific systems are included: central air and exhaust systems, fire and domestic water, carbon dioxide, steam, natural gas, heating plants, cooling tower water, cooling towers, wet and dry coolers, general purpose and mobile cryogenic equipment, and pressure vessels and related systems that are not under the control of the Pressure Systems manager.

The Contractor's Quality Assurance and Safety & Health personnel (see requirements in Section C.8.5) shall interface with the GRC organizations on a regular basis.

C.4.11.7 Authority Having Jurisdiction (AHJ). At GRC, the AHJ is the individual responsible for implementing the fire safety provisions of NPR 8715.3, NASA General Safety Program Requirements. The AHJ has been delegated the authority by the Center Director for approving all life safety and fire protection system installations, procedures, equipment selections, testing, and maintenance at both GRC Lewis Field and Plum Brook Station. In addition, the AHJ is authorized to enforce the provisions of the applicable fire and building codes and shall have the authority to render interpretations of these codes, to adopt policies, to establish procedures and regulations in order to clarify the application of its provisions.

C.4.11.8 Pressure Systems Manager (PSM). The PSM is responsible for implementing the pressure systems compliance program required under NPD 8710.5 and STD 8719.17. The PSM has been delegated the authority by the Center Director for approving pressure system installations, procedures, equipment selections, testing, and maintenance at both GRC Lewis Field and Plum Brook Station. PSM is charged with interpreting and assuring compliance with all applicable National Consensus Codes and Standards (NCS) such as ASME B31 series piping Code, ASME Boiler and Pressure Vessel Code, API Recommended Practices, CGA standards, etc. (see app J for full listing of applicable NCS). The PSM has authority to render interpretations of these codes, to adopt policies, to establish procedures and regulations in order to clarify the application of it NCS and agency policy provisions.

C.4.11.9 Energy & Environmental Management Organization. The GRC Energy & Environmental Management Office provides overall coordination and integration of the Center's energy and environmental efforts. This office is responsible for establishing energy and environmental metrics, in compliance with federal, state and local government regulations and mandates, and in alignment with Agency sustainability policies. The office oversees the planning and implementation of institutional initiatives to ensure synergy, environmental benefits and energy savings.

C.4.11.10 Configuration Control Organization. This organization has the responsibility to provide direction, management and assistance of facility drawings to GRC civil servant and contractor personnel. The GRC Configuration Control organization provides the following services:

C.4.8.10.1 Facility Drawings Configuration Control
C.4.8.10.2 Facility Drawings Reproduction Services
C.4.8.10.3 Facility Engineering Drawings Retrieval & Assistance Program (FEDRAP)
C.4.8.10.4 Glenn Drawing Information System (GDIS)
C.4.8.10.5 Facilities Electronic Data Management System (FEDMS)
C.4.8.10.6 Facilities Drawing Central Web Site (FDC)

C.4.11.11 Waste Management and Disposal Contract. Anyone who generates, stores, manages handles or transports hazardous waste is required to take RCRA Training. RCRA Training records shall be kept on-site. GRC has an existing contract for the disposal of solid, liquid, and hazardous wastes. The Center's general goal is to divert collected recyclables and waste from the waste stream by collecting and redirecting materials to an appropriate recycling facility. Those waste materials that cannot be recycled are segregated and directed to an approved disposal facility. Waste management and disposal services are currently available from 7:00 a.m. to 3:30 p.m., Monday through Friday.

Project Derived recyclables and wastes are defined as any unused, spent or waste materials resulting from activities at GRC. Solid Waste is defined is defined in 40 CFR 261.2. Examples of Solid Waste include all municipal waste, compostable, recyclable and non-recyclable, including paper, cardboard, aluminum cans, metal, glass, plastic, landscaping debris, wood, wood pallets, polystyrene, electronic waste, toner cartridges, asphalt (street sweepings) and other miscellaneous debris both inside containers and in the immediate vicinity of the containers. All solid waste, identified by the Government as recyclable, is recycled. All landfills and receivers of material (scrap metal, wood, plastic, and glass) are approved by the Energy and Environmental Management Office at GRC.

The Contractor shall work with the COR to utilize the existing contract for the disposal of solid, liquid, or hazardous wastes associated with this contract through coordination's with GRC Waste Management using Work Requests or IDIQ tasks. This includes the handling and disposal of any project derived recyclable or waste materials such as CFC refrigerants, PCBs, asbestos, lead, petroleum-based wastes, storm and sanitary effluent, storm water debris from structures, sediment, slurries, paint related materials, debris, hydraulic fluids, containerized gasses and chemicals.

C-4.11.12 Janitorial Contract. GRC LF has a stand-alone janitorial contract for office trash pickup, restroom cleaning, floor cleaning, and other miscellaneous cleaning services that can be ordered on and IDIQ basis. These services will be furnished for all Government-furnished office space provided under this contract at no cost to the Contractor.

Janitorial services for other Government-Furnished Facilities (GFF) provided under this contract (e.g., shop space, material storage space, etc.) are not provided. In these instances, the Contractor shall provide housekeeping type services to ensure areas that comprise the CPS and house Cryogenic work areas associated with this contract are free of clutter, dirt, debris and hazards.

C-4.11.13 Facilities Operations, Repair & Maintenance (FORM II) Contract. GRC LF has a stand-alone contract for the operations, repair and maintenance of all institutional equipment and systems at the Center. This includes HVAC, plumbing, underground utilities, centralized plants (steam and chilled water), fire detection & suppression systems, chemical treatment of water systems, low & high voltage electrical, electrical dispatch services, life safety systems, and security systems.

Typical CROM/FORM interfaces include the following:

C-4.11.13.1 Work Involving Underground Systems. For work requiring maintenance or repair of underground piping or conduit (e.g., underground Combustion Air piping, Service Air piping, etc.), the FORM Contract will provide the excavation services.

C-4.11.13.2 High Voltage Electrical System Switching, Scheduling & Isolation. Work under this contract may require switching, scheduling and/or isolation of high voltage electrical systems (600 V and greater). These services are provided by the FORM Contractor. The Electrical Dispatch Office is located within the Central Control Building No. 143

C-4.11.13.3 Cooling Tower Services. As is indicated in this SOW, the CROM Contractor is responsible for operations, maintenance & repair of five large GRC cooling towers. However, the FORM Contractor is responsible for maintenance and

repair of the cooling tower fire detection/suppression systems and for the chemical treatment of the cooling tower water systems. Therefore, there must be coordination of these activities between the two Contractors.

C-4.11.14 Test Facilities Operations, Maintenance & Engineering (TFOME). GRC has a stand-alone contract for the operations, maintenance, repair and engineering of aerospace ground test facility equipment and systems. Many of these facilities utilize CPS services for simulating high speed, high altitude, or for air-breathing engine combustion requirements. Consequently, there may be coordination required between the CROM and TFOME Contracts.

C.4.11.15 Electrical Power Switching, Scheduling and Outages. For any work involving electrical voltages in excess of 600 V, the Contractor shall coordinate and schedule work with the Government's Power Dispatch Office, located in the Central Control Building No. 143.

C-4.11.16 Interfaces with Other Contractors. The CROM Contractor shall cooperate with GRC's CPS maintenance, research test cell maintenance, janitorial, waste disposal, security, logistics, construction, environmental, and all other contractors and avoid conflicts with the other contractors' performance and work schedules. Under no circumstances shall additional work be performed at the request of another contractor without the approval of the COR. In the event of conflicts with other contractors that cannot be satisfactorily resolved, the matter shall be referred to the COR for a decision.

C-4.9 Operations & Maintenance Personnel Participation in GRC Projects. Large repair, rehabilitation and new construction projects at GRC are typically accomplished outside the scope of this contract and are issued as Invitation for Bid (IFB) packages. Often, there is a need to include CPS operations and maintenance and/or Pressure Systems personnel participation during the final design, construction and turnover phases of these projects. This participation could ensure that equipment and systems are designed and installed with considerations for maintainability.

As directed by the COR, the CROM Contractor shall provide personnel to participate in the final design kickoff meeting and the 30%, 60%, and 90% progress meetings for these projects. These services shall be included as part of the Base Work scope for this contract.

If CROM services are required during the construction and/or turnover phases of these projects, these services shall be covered under the IDIQ portion of this contract.

C-5. GOVERNMENT FURNISHED PROPERTY AND SERVICES

C-5.1 General. The Government will provide the Contractor the use of certain Government-owned facilities, equipment, materials, and information technology (IT) equipment. This property and these services shall be used only for activities associated with this SOW. The use of Government property for other purposes is prohibited. The use of Government Property must be in accordance with relevant Federal laws and regulations and all Agency and Center procedures. All such facilities, equipment, and materials will be provided at the start of the contract in "as is" condition.

C-5.2 Joint Inventory. The Contractor and the COR shall conduct a joint inventory during the phase in period but not later than five (5) days after commencing work under this contract to determine the exact number and serviceability of GFF, GFE & GFM (tools, equipment and materials, etc.) offered to the Contractor. Within thirty (30) days of this inventory, the Contractor shall provide the COR with a written listing of all facilities, equipment, tools and materials that the Contractor shall use and for which the Contractor shall assume accounting responsibility. Government furnished items shall not be removed from the NASA Glenn Research Center, unless approved in advance by the COR.

The Contractor and the COR shall conduct a joint inventory once a year and the Contractor shall provide an inventory list at any time throughout the life of the Contract upon request by the COR.

C-5.3 General Inventory. The Contactor shall maintain an inventory list of all electrical and mechanical parts and materials, including spare part over $500. The Contactor shall maintain an inventory of all electronic and control equipment, regardless of the dollar amount. In addition, the Contractor shall report on all changes to inventory once a month to the COR.

> **C-5.3.1 Quarterly Spare Part Inventory Reports.** The Contractor shall provide a quarterly report detailing the current spare parts inventory list, highlighting the critical spares that are below the minimum quantity required, along with changes to the inventory and proposed purchase requirements for replacement parts to maintain inventory at required operational backup level. The Contractor shall provide this report to the COR by the 15th of September, December, March and June. Included in the report shall be a list of equipment out for repair along with estimated return to service date. The Contractor shall use one standard program for managing and reporting on the status of all spare parts inventories used to support all the systems, equipment, and components covered under this contract.

C-5.4 Government Furnished Equipment (GFE). The Government will provide the Contractor the use of existing and available Government owned tools and equipment in the performance of the contract. Upon completion or termination of the contract, all Government-furnished tools and equipment, including specialized PT&I equipment and tools, shall be returned to the Government in the same condition as received, except for normal wear and tear. Tools and equipment that become worn out due to normal wear and tear shall be returned to the Government and their replacement shall be determined by the COR. The Contractor shall be held responsible for the cost of any repairs in accordance with the "Government Property" Clause of this Contract, FAR 52.245-1(Alt 1), Subsection (h). GFE shall not be removed from GRC Lewis Field unless approved in advance by the COR. At no time shall the Contractor dispose of GFE. A current listing of Government furnished tools and equipment is in the Section J-C-5.4.

> **C-5.4.1** All software and maintenance licenses shall remain property of the Government and shall be acquired under a Government name.

C-5.5 Government Furnished Material (GFM). Government owned material previously purchased to support the equipment and systems included in this contract, will be furnished to the Contractor on a "one-time" basis for use exclusively at the Glenn Research Center. The Contractor shall certify the findings of the joint inventory as described in Section C-5.2, assume accounting responsibility for all materials supplied, and shall provide documentation supporting issue/use of such material. On depletion

of material provided to the Contractor by the Government, the Contractor shall purchase necessary material to perform the work of the contract, except as otherwise specified herein.

C-5.6 Government Furnished Facilities (GFF). Government-Furnished Facilities (GFF). The Government will furnish or make available to the Contractor the facilities (buildings, structures and systems, etc.) described in Attachment J-C-5.6a. Floor plans for GFF are found in Attachment J-C.5.6. These facilities include office areas, conference rooms, shop areas, equipment storage areas, and materials storage areas. Should the Contractor choose to use the Government-furnished facilities, adequate precautions shall be taken by the Contractor to prevent fire hazards, odors, and the infestation of vermin. The Contractor shall obtain written approval from the Contracting Officer prior to making any modifications or alterations to GFF. Any such modifications or alterations approved by the Government will be made at the expense of the Contractor. At the completion of the contract, all facilities shall be returned to the Government in the same condition as received, except for reasonable wear and tear, and approved modifications and alterations. The Contractor shall be held responsible for the cost of any repairs caused by negligence or abuse on the Contractor's or on the Contractor's employees' part.

Basic janitorial services will be provided within GFF at no additional cost to the Contractor. These include trash collection, occasional floor cleaning and/or sweeping, and cleaning of restroom facilities. Recycling of office paper, aluminum cans, and plastic bottles will also be provided.

C.5.7 Government-Furnished Utilities (GFU). The Government will furnish the following utility services for the Contractor's use within the GFF at no additional cost to the Contractor (i.e., utilities will not be separately metered within GFF and back-charged to the Contractor):

C.5.7.1 Low voltage electricity for lighting and power.

C.5.7.2 Low pressure steam or heating hot water for HVAC (as required).

C.5.7.3 Natural gas for HVAC and hot water (as required).

C.5.7.4 Hot & cold potable water.

C.5.7.5 Sanitary and Storm sewage service.

C.5.7.6 Service Air/Shop Air (125 psig) for shop tools.

C-5.8 Government Furnished Information Technology (IT) Systems. The Contractor will be provided the number of Government-furnished land-line telephones and computer seats as defined below.

C.5.8.1 Land-line telephones. Land-line phones provide access to on-site GRC employees and contractors (Lewis Field and Plum Brook Station) and include unlimited local and long-distance calling capabilities. Telephone maintenance and repair services are also provided at no additional cost to the Contractor. Use of these land-line phones for non-business purposes is strictly prohibited.

C.5.8.1 Computer Seats. Computer seats (currently ACES seats) and connected to the NDC computer domain will enable Contractor employees to access NASA information systems and personnel within the NASA Active Directory. Computer stations are loaded with Microsoft Office software including Microsoft Outlook for e-mail and calendar services. In addition, these seats can be used to access the world-wide web. ACES seats will be furnished with software and hardware maintenance services and periodic hardware updates. Use of the ACES seats for non-business purposes is strictly prohibited. All ACES seat key strokes are monitored by an on-site surveillance group, and misuse of this equipment will be addressed by GRC IT Security personnel and the COR.

C-5.9 Equipment Lists. Lists of equipment and components covered under this SOW are resident in CMMS, and other databases and are provided for reference in the Technical Reference Library.

C-6. CONTRACTOR ACQUIRED MATERIALS (CAM)

C-6.1 General. Other than that provided as Government Furnished Property and Services in Section C-5, the Contractor shall be responsible for acquiring material, parts, tools, and supplies for the performance of all work under this contract. All such CAM shall be considered cost reimbursable items under this contract. All Contractor employees are responsible for providing their own personal hand tools appropriate for their particular trade. The Contractor shall not charge the Government for any of their employees' personnel hand tools including tools damaged while providing services to the Government.

C-6.2 CAM Purchases. The Contractor shall coordinate with the COR and the COR shall approve all CAM purchase requests in excess of $3,000.00 prior to purchase. The Government will not be obligated to reimburse the contractor for items exceeding $3,000.00 when prior coordination has not occurred. The Contractor shall provide a real-time program that reports to the COR detailing all purchases made under this contract regardless of cost. The Contractor shall obtain competitive quotes for material purchased in accordance with the Contract clause entitled "Competition in Subcontracting". The Government will periodically review the purchases and may, at its discretion, lower the Contractor's purchasing authority if abuses are discovered.

C-6.2.1 Approved Sources. The Government may, at its discretion, direct the Contractor to purchase the required material and equipment from Government approved sources.

C-6.2.2 Refunds. Any refunds, rebates, credits, or other amounts (including any interest) accruing to or received by the Contractor or any assignee shall be paid or passed to the Government by the Contractor, to the extent they are properly allocable to costs for which the Contractor has been reimbursed by the Government under the contract.

C-6.2.3 End of Contract. At fifteen (15) days before the Contract End Date, the Contractor shall provide a report to the COR, detailing all CAM currently in possession of the Contractor and shall turn over all CAM to the Government. All CAM purchased under this contract remains the property of the Government.

C-6.3 Parts, Components, Equipment, Vehicles and Materials/Supplies. The Contractor shall provide new or factory reconditioned direct replacement parts and components when providing maintenance, repair, and minor construction services as described herein. All replacement units, parts, components and materials installed by the Contractor shall be compatible with that existing equipment on which it is installed; shall be of equal quality to the original equipment specifications; shall be used in accordance with the original design and manufacturer intent and shall comply with the applicable specifications. If the original manufacturer has updated the quality of parts for current production, those parts shall be approved by the Government prior to procuring such parts.

C-6.4 Documentation. The Contractor shall obtain and maintain manufacturer's operating instructions and maintenance manuals on all new equipment installed by the Contractor. All documentation shall be stored in the TRL. See existing Manuals in the TRL.

C-6.5 Material Certificates, Descriptive Data and Samples. When requested by the COR, the Contractor shall submit applicable certificates of compliance, manufacturers' descriptive data, and product samples for evaluation.

- ✓ Material certificates and samples (where applicable) shall be obtained from material manufacturers attesting that materials meet minimum design specifications.
- ✓ Manufacturers' descriptive data shall include the name of the manufacturer, model number, catalog cut, and other identifying data and information describing the performance, capacity, rating, and application/installation instructions which clearly illustrate that the proposed item meets applicable standards.

- ✓ Product samples shall include a sufficient quantity of material to allow for complete analysis and evaluation by the Government.

C-6.6 Equipment Manufacturer's or Installer's Warranty. Equipment, components, and parts with existing warranties shall not be removed or replaced without prior approval of the COR. All defects in material or workmanship, defective parts, or improper installation and adjustments found by the Contractor shall be reported to the COR so that necessary action may be taken. The Contractor shall maintain and keep an electronic record of the equipment, parts, and components that are covered by warranty and the duration of such warranties.

C-7. CONTRACTOR MANAGEMENT AND ADMINISTRATIVE REQUIREMENTS

C-7.1 General. The Contractor shall manage the total work effort associated with Central Process System Recertification, Operations, Maintenance, Repair, and all other services required herein to assure successful and timely completion of services in this contract. Included in this function are the full range of management and administrative responsibilities.

C-7.2 Required Personnel and Functions

C-7.2.1. Staffing. The Contractor shall provide a staff of personnel with the necessary expertise and qualifications to assure the work is performed in accordance with the standards specified herein.

C-7.2.2 Project Manager. The Contractor shall appoint an on-site Project Manager with the authority for all coordination and direction of activities.

C-7.2.3. Critical Personnel Listing. The Contractor shall provide to the COR a list of the Contractor's critical personnel and a means of contacting these individuals in the event of an emergency or during off-hours. The Contractor shall notify the COR of changes in the list of the Contractor's critical personnel within three (3) working days.

C-7.2.4. Contractor Licensing, Certification, Qualification and Specific Experience Requirements. The Contractor shall provide personnel that have the appropriate skills for that trade. The degree of skills shall be commensurate with that required for the work. Those personnel working in trades, whose performance requires license or certification or both, shall be so licensed/certified and said documentation shall be made available to the COR upon request. The Contractor shall have all necessary licensing, certification, qualification and training requirements for performing work under this contract remain current. Training classes shall be approved by the Government.

C-**7-2.4.1 CPS Equipment Operator Qualification.** For qualifications of the CPS Equipment Operators see Section C.8.

C-7-2.4.1 PSO certification requirements. For certification and qualification for the PSO personnel see Section C.11.

C-7.2.5 Security Access. The Contractor may be required to work in secured areas at GRC. Contractor employees needing regular access to these areas to perform their jobs shall be trained by the Government for access and the Contractor shall obtain proper badges to allow easy access for accomplishing work.

C-7.2.6 Training. The Contractor shall provide the necessary training to insure that personnel have the appropriate skill levels to perform their trade. This includes training to maintain or acquire additional skills. The Contractor shall be required to submit a Training Plan to the COR for review and approval on a semi-annual basis.

C-7.3 Computerized Maintenance Management System (CMMS). The Contractor shall utilize the Government's Computerized Maintenance Management System (CMMS) to manage activities required by this contract. The Government system is currently MAXIMO. Other mandatory CMMS entries include observed operating conditions, assessment of equipment, deficiencies detected, corrections made, and quantities and types of material repaired or replaced. The Contractor shall adhere to Federal, NASA and GRC Information Technology (IT) policies.

C-7.3.1. The Contractor shall be able to perform the required CMMS functions at the start and for the duration of this contract. The Contractor shall not attempt to interface the Government CMMS system with any other CMMS, database, spreadsheet, or other

software programs. The Contractor shall not log or record any proprietary information on the MAXIMO system.

C-7.3.2. Maintaining, Populating, and Updating CMMS Data. The Contractor shall continually update the CMMS database and is responsible for its accuracy as it relates to this SOW. All documents shall be filed or entered within seven (7) working days after completion of each preventive maintenance, inspection, recertification, etc. event. Within thirty (30) days after contract start, the Contractor shall provide in writing to the COR an overall assessment of the accuracy of the information contained in the CMMS database as it relates to this SOW.

C-7.3.3. The Contractor shall follow the procedures to ensure CMMS is current and that all of the equipment and tasks are accurately entered.

C-7.4 PSD Pressure Systems Database (PSD). The Contractor shall update and maintain information within the PSD. Data to be maintained includes physical configuration data (component brand, make, model, size, and capacity information, etc.) of components and systems, as well as In-Service Inspection (ISI) status information of components and systems. The contractor shall occasionally be required to coordinate updates or repairs to the PSD application by working with GRC IT staff separately assigned to administer/program the application. The contractor shall perform regular audits and error checks of PSD to assure data integrity and shall participate in the development and implementation of all IT Security Plans and requirements.

C-7.5 Risk Management Assessment Function. The Contractor shall perform Risk Management and Assessment to identifying the top risks that may impact performance on this contract, as viewed by the Contractor, and the proposed mitigating strategies for those risks identified. Such risks might include, budget deficiencies, personnel shortage, lack of training, unavailability of equipment to meet demand, etc..

C-7.6 Contractor Quality Control (QC) Function. The Contractor shall provide a Quality Control Plan within 30 days of award. The Contractor shall establish and maintain a Quality Control Program to ensure that the work performed under the contract conforms to the contract requirements.

C-7.6.1 Preventive Maintenance. As part of the Contractor's QC plan, the Contractor shall provide to the COR a Monthly PM Work Schedule Report, on or about the 20th of each month, that details all Preventive Maintenance tasks completed in the previous month, all backlog PM tasks, and all the PM tasks scheduled for the upcoming month. Reference section C-8.1.14.2.

C-7.6.1.1 Random Sample. At a minimum, the Contractor shall choose, at random, 10% of the work orders completed and submitted them for inspection by the Contractor's own Quality Assurance Manager.

C-7.6.2 IDIQ Tasks. As part of the Contractor's QC plan, the contractor shall indicate how they shall provide quality inspections with each IDIQ Task, which includes but is not limited to Final walk-throughs with TR and COR.

C-7.7 Government Quality Assurance (QA) Function. All services performed by the Contractor are subject to Government inspection. The Government's Quality Assurance Surveillance Program (QASP) is not a substitute for quality control by the Contractor. The

Government reserves the right to choose the inspection method and vary the inspection methods utilized during the work, without notice to the Contractor.

C-7.8 Safety & Health Function. The Contractor shall utilize proactive and innovative safety practices on a continual basis throughout the contract period. The Contractor's Safety and Health Program shall comply with Occupational Safety and Health Administration (OSHA) Regulations and the GRC Safety & Mission Assurance (SMA) Requirements which are defined in the Glenn Safety Manual (see General Library for GLM QS 1700.1) and the Glenn Occupational Health Programs Manual (see General Library for GLM-QS-1800.1).

The Contractor's personnel and subcontractors shall only perform work for which they are specifically trained. In addition, the Contractor's staff shall maintain a safe and clean worksite and report all incidents or near-misses to Contractor supervisors. Within 24 hours of the incident, the Contractor shall input the initial mishap or close call report into the NASA Mishap Information System (NMIS). The Contract shall implement effective job hazard analyses that will document, control, and communicate hazards identified during the execution of tasks performed under this SOW that is not covered under the site-specific Health and Safety Plan.

C-7.9 Work Control Function. The Contractor shall implement all necessary work control procedures to ensure timely and successful completion of work requirements, as well as to permit tracking of work in progress. The Contractor shall plan and schedule work to assure material, labor, and equipment are available to complete work requirements within the specified time limits and in conformance with the quality standards established herein. Upon the request from the COR, schedule and status reports shall be provided within the time frame specified in the request.

C-7.10 Operations Plan. The Contractor shall provide to the COR within thirty (30) days following award of the contract their Operations Plan that describes how the operational requirements included in this contract will be accomplished. The Contractor's Operations Plan shall be submitted in writing and in an acceptable electronic format. The Operations Plan shall include written procedures, check sheets, and define the qualifications and duties of assigned equipment and system operators.

C-7.10.1 As a minimum, the Operations Plan shall define how the Contractor shall [1] manage, operate, control, monitor and inspect the CPS, instrumentation, control, mechanical, electrical, and electronic equipment, associated ancillary and auxiliary equipment and systems for proper operation; [2] perform OCMR and PMs; [3] report problems; [4] troubleshoot equipment or system failures and; [5] make minor adjustments to equipment located throughout the research support facilities; [6] perform cross-training.

C-7.11 Progress Review Meetings. The Contractor shall conduct monthly progress meetings with the Government. The monthly meeting will review overall contract status, work completed versus work scheduled, problems, issues and concerns. The meeting shall be held during the third week of the month. Typical meetings include OCR/MCR work order review meeting, IDIQ Task review meeting, Condition Monitoring meeting, PSO prioritization meeting, etc..

C-7.11.1 Participation in Other Meetings. The Contractor shall participate in other meetings, such as but not limited to, FD's Continuous Improvement and Lessons Learned meetings and Facilities Test Division monthly Facility Managers' meeting, and other meetings as requested by the COR and other Work Order/Task Order requirements.

C-7.12 Communication with other Government personnel. The Contractor shall communicate and inform other Government personnel including CORs, ACORs, TRs, Systems Managers,

Facilities Managers, Building Managers, and System Engineers in emergency situations and when deemed necessary based on the situation.

C-7.13 Documentation. The Contractor shall maintain a technical library consisting of manuals and documents needed for CPS and Pressure Systems. The Contractor shall be responsible for updating and maintaining all record drawings, electrical and mechanical one-line wiring and elementary drawings, schematics, manuals, reports, check-sheets, and all other documentation (including software documentation) which comprise the CPS and associated PSPV systems for all work performed under this contract, and work by others as directed by the COR. The Contractor shall utilize NASA specified software packages, as appropriate, to update documentation.

C-7.13.1 The Contractor shall have between 15 and 45 days, depending upon the complexity and magnitude of an IDIQ task, to submit to the Government all related Red Lined drawings and documentation. The Contractor and the Government will jointly determine a realistic date for the Contractor to complete all required drawings and documentation; all red lined documentation shall be completed and released to the Government before the end of this contract. The Contractor shall follow the GRC configuration control guidelines regarding the configuration control of drawings and components.

C-8 CENTRAL PROCESS SYSTEMS (CPS) OPERATIONS, MAINTENANCE & REPAIR

C-8.1 BASE WORK OPERATIONS, & ELECTRICAL/CONTROLS MAINTENANCE AND REPAIR

C-8.1.1 General. Operations, is defined as day to day services required to operate the CPS equipment and systems and all the services required to maintain and repair these systems including the electrical/controls systems and equipment used to monitor and control the equipment and systems. The Contractor shall perform work in accordance with the existing operations and maintenance manuals, procedures and manufacturers' literature. The Contractor shall ensure that all equipment remain clean, free of oil and dirt. The Contractor shall also ensure all equipment and facilities under their jurisdiction appears pristine and ready for tours and inspection at all times. The Majority of the equipment is operated remotely from control rooms using automated process control systems. The Contractor shall not modify any CPS Systems without Government approval unless it is a "like kind" replacement that requires no field or drawing modifications.

C-8.1.2 Equipment Operation. The Contactor shall operate the following:

- 10 psig Refrigerated Air Systems and Expanders (TE-3,4,5 & 6),
- 40 psig Air Compressors (C-1,2,10,11,12,13),
- 150 psig Air Compressors (C-3,7,16 & 17),
- 450 psig Air Compressors (C-4,5 & 18),
- 1250 psig Air Compressor (C-8),
- 125 psig Service Air Compressors (SA-20,21,22,23),
- Altitude Exhausters (E-38, 39,40,41,42,43,44,45,46 & 47),
- Atmospheric Blowers (AEF-19 & 20),
- Variable Frequency Power System (Converters C,D,E,F,G,H,J,K,L & M), and the
- Cooling Towers (CT 1, 3, 4, 5 & 6).

C-8.1.2.1 The Contractor shall operate the Center's service air and cooling tower water systems ensuring that these services are available on a 24/7/365 basis.

C-8.1.2.2 The Contractor shall operate all the auxiliary and/or ancillary systems associated with the equipment identified such as, but not limited to, oil and hydraulic systems, exciter sets/excitation units, High and Low Voltage electrical systems and/or switchgear, Cooling Tower Water systems, and de-watering systems.

C-8.1.3. Central Air Dispatch (CAD)

C-8.1.3.1 Scheduling of Operations. The Contractor shall operate all the CAD valves using the operator consoles in CPSDC. CAD personnel shall issue a daily Research Facility Test/Central Process Services Systems Requirement Schedule, which is often modified during the morning Conference Call and is updated throughout the day. This web-based schedule will serve as notification to the Government of equipment requirements needed to support research operations for each day. The Contractor shall maintain communications with Research personnel, and observe the published operations schedule, to ensure that they meet all operations requirements. The Contractor shall keep the Government up-to-date on equipment availability. The Contractor shall implement Mechanical System lock-out/tag-out following all safety requirements as defined in the GRC Safety Manual, Chapter 9.

C-8.1.4 Operation of the CPS

C-8.1.4.1 Operation Procedures. The Contractor shall update and maintain all operating procedures, such as, Operations check sheets, hardwired shutdown procedures, calibration

procedures, LO/TO procedures, and all other related procedures located in the Operator's Console or elsewhere. See Section J-C-8.1.4.1 for procedures. The Contractor shall obtain the SM approval prior to making any final changes to the procedures. The Contractor shall maintain all these procedures on the Operator Consoles.

C-8.1.4.2 The Contractor shall provide the COR documentation verifying an annual review of all the CPS operators' sequence check sheets. The Contractor shall provide documentation before September 30th for each year of this contract.

C-8.1.4.3 The Contractor shall maintain communications with the Electric Power Dispatcher personnel. Communications shall include, but are not limited to: daily operational requirements, changes made throughout the course of the day that effect operations, coordination of operational activities, troubleshooting of control and operational problems, preparation of equipment for inspections and testing, and conducting necessary system isolation and safety Lockout/Tagout (LO/TO) activities.

C-8.1.4.4 The Contractor shall issue an accurate daily run report that identifies all tagged out equipment, all equipment used throughout the day, any anomalies and corrective actions taken. Example of daily run report is given in Section J-C-8.1.4.4.

C-8.1.4.5 The Contractor shall communicate any issues and concerns related to the CPS to the Government personnel including CORs, ACORs, Systems Managers, Facilities Managers, Building Managers, and System Engineers when deemed necessary based on the situation.

C-8.1.4.6 In certain testing configurations the Contractor shall be required to maintain communications with the test researcher. These testing configurations shall be made known to the Contractor as soon as they are identified by the Government.

C-8.1.4.7 The Government may modify/add/delete systems in the future. Lists of equipment, manuals, and components covered under this reside within the CMMS.

C-8.1.5 Operations Personnel Functions and Qualifications. The Contractor shall provide qualified personnel to accomplish Operations and Maintenance activities associated with the CPS, the CPSDC and its support systems and equipment in the performance of this contract. Contractor qualified personnel shall possess the ability to perform:

- Electrical Equipment Maintenance,
- Mechanical Machinery Maintenance, and
- Electronic Device Maintenance

C-8.1.5.1 Operator Levels of Qualification. Currently, there are four levels of qualified individuals (Operators) who operate and maintain the equipment and systems that comprise the CPS.

C-8.1.5.1.1 Field Equipment Operation (FEO). FEO consists of individuals who are capable and qualified of providing watch-standing and rover duties during start-up, equipment operations and systems shutdown. These individuals are customarily entry level individuals or other individuals new to CPS operations. The FEO function includes the field pre-runs and post-runs for the equipment being operated that day. Qualified FEO personnel shall have sufficient electrical/controls, electronic and/or mechanical skills to perform day-to-day watch-standing operations, maintenance and troubleshooting.

Watch-standing and Tending is defined as attendance type work requiring the presence of qualified persons to perform specific duties during a specific or scheduled time period.

C-8.1.5.1.2 Field Console Operation (FCO) Level I. The FEO function is a prerequisite for a FCO Level I function. FCO Level I consists of individuals who are capable and qualified of configuring, starting, stopping, controlling and monitoring of the CPS

equipment from the field consoles. Qualified FOC Level I operators shall remain present at the console during operations to make adjustments, monitor conditions for alarms and any anomalies and orchestrate any corrective actions.

C-8.1.5.1.3 Field Console Operation (FCO) Level II (previously SCO). The FCO Level I function is a prerequisite for a FCO Level II function. The FCO Level II function consists of being proficient in troubleshooting and identifying problems with CPSDC and the associated controls equipment and instrumentation.

C-8.1.5.1.3.1. Examples of Control equipment and instrumentation include:

- Operator Consoles,
- ABB Company's Bridge Controllers programmed with languages such as Function Code software,
- Programmable logic controller (PLC) sequence logic, process controls,
- CCC pressure and Surge Controllers,
- Input/Output devices,
- S800 I/O,
- Field devices such as Exciters, Multilin/PQM/IQs, Servo-amplifiers, transmitters, and any other devices used for monitoring and control.

C-8.1.5.1.3.2 The FCO Level II function also include maintaining and troubleshooting all computer related hardware such as, but not limited to, computers, computer servers, routers, switches and all other network related hardware.

C-8.1.5.1.3.3 The FCO Level II function does not include CPS engineering or modifying the System Software.

C-8.1.5.1.3.4 Troubleshooting is defined as defining and resolving an anomaly. To conduct troubleshooting, the Contractor's staff shall have sufficient knowledge of the overall system; this knowledge shall enable an operator to resolve problems within the CPSDC starting with the operator console, and everything in between all the way to the field device. The Contractor shall make every attempt to troubleshoot and resolve issues utilizing their staff. If problem persists, the Contractor shall contact the appropriate engineers within the Facilities Division for troubleshooting assistance and engineering support.

C-8.1.5.1.3.5 Each shift of operation in each building shall consist of FCO Level II functions as a minimum during operation along with the necessary FEO and FCO Level I functions.

C-8.1.2.4 Field Console Operation (FCO) Level III (previously SSCO). The FCO Level II function is a prerequisite for a FCO Level III function. The Contractor's FCO Level III operators shall have full understanding of how all components of CPS including CPSDC work together to deliver CPS Services to the research facilities. This involves performing first line end-to-end troubleshooting without Government or Engineering assistance.

C-8.1.7 Operations Corrective Repair (OCR). An OCR is the name given to a repair task when a work order is entered into the CMMS to repair or correct an anomaly that developed within the CPS. An OCR can be identified by either the Contractor or the Government before, during, or after operations, as necessary to correct problems that would interfere with scheduled operations or to prevent injury to people, equipment or the environment.

C-8.1.7.1 The Contractor shall report any and all equipment problems, malfunctions, breakdowns, and related repair deficiencies in the Daily Run Report.

C-8.1.7.2 The Contractor shall inform CAD and ED when the problem has been identified and corrective action planned. All OCR work shall be reported in CMMS in the form of Work Orders.

C-8.1.7.3 The Contractor shall not alter any hardware or equipment without the approval of the COR. The Contractor shall be allowed to replace defective parts found during the troubleshooting process with like kind components

C-8.1.8 OCR Work Orders. The Contractor shall perform the OCR Work Orders as soon as possible in order to get CPS equipment available for the next run, to ensure that all operational requirements are met.

C-8.1.8.1 OCR Work Orders are limited to $5,000.00. In the event that an OCR work order is expected to exceed this limit, the Contractor shall notify the COR immediately to insure continuity of work.

C-8.1.9 Operation of CPS Control Equipment Hardware.

C-8.1.9.1 The Contractor shall be responsible for day to day operation of the Central Process DCS hardware. The Contractor shall notify the COR of any major problem found and/or corrected in during the troubleshooting process. The Contractor shall have the capability to troubleshoot and correct problems with the computer/network hardware such as:

- DEC Alpha,
- IBM PC-compatibles,
- Bridge Controllers (BRC),
- Programmable Logic Controllers (PLC),
- PLC I/O,
- Compressor Control Corporation (CCC) Controllers,
- Solid-State Exciters,
- Static Frequency Converters (SFC),
- Uninterruptible Power Supplies (UPS)
- Hardware added during the life of the Contract.

C-8.1.10 Central Process Services Schedule (CPSS). The Contractor shall publish every Thursday by 2:00 pm the weekly Central Process Services requirement's schedule over the Integrated Desktop Environment (IDE). The Contractor's first priority shall be to ensure the equipment is ready for operation to meet the research requirements. Examples of the CPSS schedule are given in Section J-C-8.1.10.

C-8.1.10.1 The Government retains the right to update the schedule throughout the week, as research requirements, equipment problems, and changing priorities among research and maintenance groups occur.

C-8.1.10.2 The "start" and "stop" times indicated on the schedule refer to the times that the specified test cells are scheduled for CPS services to begin and end. The Contractor shall ensure that pre-run checks, setups, starts, synchronization, loading, coupling, paralleling operations, etc. are completed within a time frame that allows those start and stop times to be met.

C-8.1.11 Specialized Operations Requirements

The Contractor shall provide the necessary operator services to transfer, vaporize, cascade and/or pump liquid and gaseous hydrogen when required on a work order basis.

The Contractor shall be responsible for day to day operation of the Central Process DCS hardware and software. This includes the ability to troubleshoot and identify problems and take corrective action with the hardware for computer/network such as the DEC Alpha, IBM PC-compatibles, Bridge Controllers (BRC), Programmable Logic Controllers (PLC), PLC I/O, Compressor Control Corporation (CCC) Controllers, Solid-State Exciters, Static Frequency Converters (SFC), Uninterruptible Power Supplies (UPS), etc.. Any Software issues identified shall be reported to the COR and TR. Such software issues include operating systems, networking protocols, languages and database management systems such as VAX/VMS, UNIX System V, MS-DOS, MS Windows, TCP/IP, DECnet, NETBIOS, BASIC, Visual BASIC, C, SQL, dBase III+ and compatibles, Function Code Software, Batch 90 software, "C" utility program (FDI), human-machine interface graphics display software, PLC software and other hardware and software added during the life of the Contract.

C-8.1.12 Controls/Electrical Preventive Maintenance

C-8.1.12.1 Scheduling of All Maintenance Activities. The Contractor shall document a completion date for all PM work on the monthly PM Work Schedule Report and shall complete all scheduled PM's during the period specified in the work order.

C-8.1.12.2 Monthly Preventative Maintenance Work Schedule Report. The Contractor shall provide to the COR a Monthly PM Work Schedule Report, on or about the 20th of each month, that details all Preventive Maintenance tasks completed in the previous month, all backlog PM tasks, and all the PM tasks scheduled for the upcoming month.

C-8.1.12.3 Preventive Maintenance (PM) Requirements. The maintenance schedule shall accommodate PM procedures as defined in the CMMS database and include routine scheduled items.

C-8.1.12.3.1 Procedures. PM procedures are defined in the Work Instructions resident in CMMS, and provided for reference in the Electronic Bidders Library. The Contractor shall use CMMS to manage its PM program. The Contractor activities shall include updating records, procedures, instruction codes, and nameplate data, scheduling, and recommending improvements to GRC's PM program. The data entered in CMMS becomes the property of the Government.

C-8.1.13 Hardwire Shutdown Verifications & Calibrations. The Contractor shall verify the Hardwire Shutdowns and Calibrations on any system or piece of equipment which has been taken out of service for major repair or rehabilitation or has been replaced due to component failure or wear.

C-8.1.14 Safety Permits. The Contractor shall be responsible for obtaining and maintaining all Safety Permits needed to operate CPS equipment. The Safety Permit process is described in the Glenn Safety Manual, chapter 1A, provided in Section J-C-8.1.14.

C-8.1.15 Design Field Support. The Contractor shall provide field electrician support during the design phase of a task. Historically, CPS electricians have assisted support engineers in the design phase of an IDIQ task that enhances the CPS. Example of assistance include verifying the accuracy of the field conditions to the drawings. All CPS engineering services are provided by others.

C-8.1.15.1 Design Review. The Contractor shall attend Design Reviews held by others and provide comments and feedback of the design drawings submitted to the Contractor for Field verification.

C-8.2 BASE WORK MECHANICAL MAINTENANCE AND REPAIR

C-8.2.1 General. The Contractor shall ensure that all the equipment, systems and components that comprise the Central Process System and the Pressure Vessels and System are maintained in working order throughout the life of this contract. The Contractor shall perform maintenance and repair activities that include, but are not limited to, maintain, inspect, repair, supply, replace, recondition, install, modify, disassemble, lift, relocate, assemble, align, balance, test, and calibrate. The Contractor shall, upon request by the COR, provide their services to the research community to repair their similar types of equipment on an as needed basis. The Contractor shall ensure that their maintenance activities don't interfere with the research run schedule.

C-8.2.2. Equipment. The Contractor shall perform these maintenance and repair activities on electrical/controls, mechanical, pneumatic, hydraulic, electro-pneumatic and electro-hydraulic components and systems; CPS components and systems include, but are not limited to, valves (whether large or small gate, butterfly or globe type, either powered, hand operated or control, relief, solenoid, servo or vacuum), other components include actuators, hoses, pressure regulators, accumulators, pressure pumps, vacuum pumps (mechanical, diffusion, ionization, turbo-molecular, and Roots blowers), light and heavy duty equipment, plant or research machinery, drive equipment, and all other ancillary equipment.

C-8.2.3. Maintenance Personnel Qualifications. The Contractor shall provide qualified personnel to accomplish maintenance and repair activities. Maintenance personnel shall have experience in their respective technical fields. The Contractor's maintenance personnel shall be experienced and capable of working on the above described components and experienced in mechanical machinery maintenance, Electrical/Electronic device maintenance, and piping systems maintenance.

C-8.2.4. Maintenance Standards. Using the guidelines set forth in NASA's Maintenance and Operations of Institutional and Program Facilities and Related Equipment document NPD 8831.1E and NASA's, Facilities Maintenance Management document NPR 8831.2E, the Contractor shall partner with the Government to improve their maintenance program by recommending additions, deletions, or modifications to the current maintenance activities to the Government.

C-8.2.4.1. All recommendations made by the Contractor shall be cost effective and geared to increase the overall reliability and ensure continuous improvement to the health of the CPS.

C-8.2.4.2. The Government will provide preventative maintenance procedures which will be available in the Technical Reference Library and otherwise will be listed in the Government's Computerized Maintenance Management System (CMMS).

C-8.2.4.3. Copies of NASA NPD 8831.1E Maintenance and Operations of Institutional and Program Facilities and Related Equipment and NPR 8831.2E Facilities Maintenance Management can be found in the Technical Reference Library.

C-8.2.4.4 The Contractor shall provide a review of the government's annual maintenance plan.

The Maintenance and Operations of Institutional and Program Facilities and Related Equipment document NPD 8831.1E can also be found at the following URL address: http://nodis.hq.nasa.gov/displayDir.cfm?t=NPD&c=8831&s=1E.

The NASA's, Facilities Maintenance Management document NPR 8831.2E can also be found at the following URL http://nodis.hq.nasa.gov/displayDir.cfm?t=NPR&c=8831&s=2E.

C-8.2.5 Reliability Center Maintenance. The Contractor shall perform maintenance and repairs using the Reliability Center Maintenance (RCM) based maintenance philosophy that is currently implemented and to be continued using the guidelines set forth in NASA NPD 8831.1E.

C-8.2.5. Reliability Center Maintenance (RCM) Program. The RCM program is primarily the responsibility of the Government. The Contractor shall be knowledgeable in implementing a RCM based maintenance program and shall follow the principles and guidelines as set forth and defined within NPR 8831.1E. The Contractor shall partner the Government in revising the currently implemented RCM based maintenance program. The current program uses a blend of RCM based maintenance practices; these practices include, preventive and programmed maintenance tasks, proactive predictive testing and inspections activities, conditioned based monitoring tasks, maintenance corrective repair (MCR) tasks and run-to-failure measures. The Contractor shall acquire system manager approval before implementing any modifications to the RCM program.

C-8.2.6. Preventive (and Programmed) Maintenance (PM/PGM). The Contractor shall perform all the preventative and programmed maintenance tasks as currently defined within the Government's CMMS. The Contractor shall use CMMS to manage its PM program. The majority of the equipment and components (assets) that comprise the CPS are in the Government's CMMS. PM frequencies and the instructions to complete a PM tasks (job plans) have already been established within the CMMS. The Contractor shall partner with the Government to maintain the accuracy of the CMMS. The Contractor shall be responsible for ensuring that they document within the CMMS all activities they perform when conducting a PM task, including updating records, procedures, job plans, and nameplate data and other findings. The data entered into the CMMS by the Contractor becomes the property of the Government. See the Section on CMMS requirements for further CMMS details and Contractor responsibilities.

C-8.2.6.1. Monthly Preventative Maintenance Work Schedule Report. The Contractor shall provide to the COR a Monthly PM Work Schedule Report, on or before the 20th of each month, that details all Preventive Maintenance tasks completed in the previous month, all backlog PM tasks, and all the PM tasks scheduled for the upcoming month. The Contractor shall document a completion date for all PM work on the monthly PM Work Schedule Report and shall complete all scheduled PM's during the period specified in the work order. The Contractor shall report all anomalies uncovered during the previous month and their recommendations to correct the finding.

C-8.2.6.2. Preventive Maintenance (PM) Requirements. The Contractor shall follow the PM instructions currently within Maximo when performing maintenance tasks. The Contractor shall partner with the Government in improving the accuracy and relevance of the instructions, the frequency of the task etc. The Contractor shall report their finding during their monthly maintenance review meeting with the Government.

C-8.2.7. Predictive Testing and Inspection (PT&I) The Contractor shall have capabilities to perform PT&I maintenance activities. The Contractor shall have employees who are trained to utilize PT&I equipment and who can conduct ultrasound, thermography, oil analysis, vibration analysis, motor circuit evaluation, motor power monitoring, acoustical leak detection, and others PT&I techniques. PT&I activities are used to monitor and trend asset conditions with the intent of minimizing maintenance activities while maintaining equipment reliability and as a basis for the consideration in eliminating certain PM tasks. The Contractor shall use PT&I technics on all of the major rotating equipment and systems, these technic shall also be used in validating new or repaired equipment. The Contractor shall notify the COR immediately if though their PT&I activities they determine a failure is imminent. The Contractor shall partner with the Government in seeking PT&I process improvements. The Contractor shall make all test data results available to the Government.

C-8.2.7.1. Condition Based Monitoring (CBM). On a monthly basis, the Contractor shall collect and review the information from their PT&I activities and from condition monitoring equipment installed throughout the CPS. The Contractor shall conduct a monthly meeting with the Government's system managers to go over their most recent PT&I results and findings. The Contractor shall correct any minor problems found during the performance of this activity as soon as practical, the Contractor shall documented their findings in the CMMS and notify the COR. The Contractor shall partner with the Government in seeking PT&I process improvements and in performing corrective actions. The Contractor shall make all test data results available to the Government.

C-8.2.7.2 Equipment Baseline Data Checks. The Contractor shall perform the necessary checks to verify baseline data for such criteria as alignments, vibrations, clearances, flows, electrical signatures, temperatures, and other observable conditions on any system or piece of equipment which has been taken out of service for major repair or rehabilitation or has been replaced due to component failure or wear.

C-8.2.7.3 Field Surveys. The Contractor shall conduct field surveys and document findings of systems and components to verify configuration and component information.

C-8.2.8. Run to Failure. The Government has determined some CPS asset are run-to fail. Any equipment not under PM/PGM or PT&I are considered run-to-fail. The Contractor shall partner with the Government to review the current assets and determine whether or not this philosophy is currently applicable for each asset; other assets can be added or subtracted from the list if determined applicable by both the Contractor and the Government.

C-8.2.9 Mechanical Repairs & Maintenance Corrective Repair (MCR). MCR is inherent to equipment and systems operations and maintenance and is unplanned work that occurs unexpectedly during the course of the day or before, during, or after operations or when maintenance and inspection activities were performed, that require immediate attention. MCR is identified by the Contractor, or the Government, and is necessary to repair problems that would interfere with scheduled operations, prevent injury to people, equipment or the environment. The Contractor shall perform all MCR identified during scheduled equipment operations. The Contractor shall be responsible for repairing all mechanical systems and component within the CPS. The Contractor shall report any and all equipment problems, malfunctions, breakdowns, and related repair deficiencies to COR via the daily run report.

C-8.2.9.1 MCR Work Order Cost Limits. The Contractor shall perform and complete MCR Work Orders as soon as possible in order to maintain equipment availability and to ensure that all operational requirements are met. The Contractor shall not incur material costs greater than $10,000 for any one MCR Work Order. The Contractor shall immediately notify the COR if they anticipate the cost of a MCR to exceed $10,000. The Contractor shall obtain COR approval before implementing an MCR greater than $10,000. The Contractor shall during their monthly review meeting report all MCR's identified and/or corrected during the previous month.

8.2.9.1.1 The Contractor shall plan and schedule this work to assure that materials, labor, and equipment are available to complete repairs within the specified time limits and in conformance with established quality standards.

8.2.9.1.2 The Contractor shall schedule work to minimize interference with the normal occurrence of Government business and mission, particularly CPS operations scheduled on the weekly Research Facility Test/Central Process Systems Requirement Schedule. Any repair task or replacement of obsolete item task (in-like kind) done by the Contractor shall be tested prior to operations

C-8.2.7 Design Field Support. The Contractor shall provide Field Mechanic support during the design, implementation and testing phases of a task which is done by others.

C-8.2.7.1 Design Review. The Contractor shall attend Design Reviews held by others and provide comments and feedback of the design drawings submitted to the Contractor for field verification.

C-8.3 Service Agreements.

C-8.3.1 CPS. The Contractor shall obtain the following Service Agreements as required by the COR.

- ABB
- Hummingbird Exceed X-Windows
- OSISoft PI Server
- Ipswitch WhatsUp Network Monitor
- GFI LANGuardSecurity Patching Software
- Solarwinds
- Data South Systems
- DBDOC
- EventSentry
- SymantecBackup,Antivirus,System Recovery
- SYMC Backup Exec Sys Rcvry Srvr 7.0 WIN
- IRD 885 Maintenance Srvice
- DLI Vibration Analyzer
- Uninterruptible Power Supply Service Agreement

C-8.3.2 PSO Software Maintenance Upgrade Notices. The Contractor shall obtain Service Agreements as required by the COR.

Typical Software include:

Ansys	1 seat
Cosmos	1 seat
Solidworks	2 seats
PVElite	6 seats
Caesar	4 seats
CadWorks	1 seat
VCESage	unlimited
Arrow	1 seat
Fathom	1 seat
MathCad	unlimited
	15
Anti-Virus	Laptops
Autocad	thru

The Government may modify this list of services agreements at any time during the life of this contract.

The Contractor shall provide an annual report to the COR which lists all anticipated service agreements, their renewal dates and costs by January 15th of every contract year.

C-8.4 IDIQ TASKS

C-8.4.1 General. IDIQ tasks are defined as build-up, repair, upgrade, and testing activities of specific CPS tasks; including Program Maintenance Tasks.

C-8.4.1.1 Regardless of the Government's funding source, the Contractor will receive a request to perform these IDIQ tasks with a Task SOW.

C-8.4.1.2 Regardless of the Government's funding source, the Contractor shall provide all the required labor, materials, and equipment to complete the task described in the Task SOW.

C-8.4.1.3 Regardless of the Government's funding source, the Contractor shall be responsible for purchasing, inventorying, and stocking all hardware and materials, including spare parts, required to complete the task described in the Task SOW.

C-8.4.1.4 The Contractor shall immediately notify the COR when a task's funding expenditure has reached the 85% level and is expected to exceed the agreed upon funding limit.

C-8.4.1.5 The Contractor shall exercise utmost caution to ensure that all charges incurred are accurately recorded against the specific task number provided by the Government for each IDIQ task.

C-8.4.1.6 The Contractor shall prepare all work implementation documents, including but not limited to, Safety Permits, individual task Health and Safety Plans, detailed schedules (using Microsoft Project), completion reports, update red-lined drawings, and other related documentation.

C-8.4.1.7 The Contractor shall provide to the COR a cost estimate for each Implementation Request within fifteen (15) working days of receipt of the request or renegotiate an acceptable date with the COR. The estimate shall provide detail on costs, materials, labor hours, and applicable fees.

C-8.4.1.8 The Contractor shall provide a Completion Report to the COR within the proposed completion date provided in their estimate.

C-8.4.1.9 The Contract shall use Microsoft Office Suite Project to monitor all work schedules and work activities. Schedule for task will be defined during the task "Kick Off" meeting.

C-8.4.2. IDIQ Personnel Function.

C-8.4.2.1 Mechanical Task Coordination Function. The Mechanical Coordination Function consists of coordination of all mechanical tasks performed by the Contractor.

C-8.4.2.1.1 The Mechanical Coordination shall be done in conjunction with the Electrical/Controls coordination if the task in an Electro-mechanical Task.

C-8.4.2.1.2 The Mechanical Coordination includes verification of all equipment that is being purchased for all the tasks.

C-8.4.2.2 Electrical/Controls Task Coordination Function. The Electrical/Controls Coordination Function consists of coordination of all electrical tasks performed by the Contractor.

C-8.4.2.2.1 The Electrical/Controls Coordination includes verification of all equipment that is being purchased for all the tasks.

C-8.4.3 Red Line Drawings and Documentation. The Contractor shall have between 15 and 45 days, depending upon the complexity and magnitude of an IDIQ task, to submit to the Government all related Red Lined drawings and documentation. The Contractor and the Government will jointly determine a realistic date for the Contractor to complete all required drawings and documentation.

C-8.4.3.1 The Contractor shall keep a copy of all Red-lines turned in to the COR in the general area of the equipment until the As-Builds are returned to the Contractor for filing.

C-8.4.3.2 The Contractor shall update operating procedures associated with each IDIQ task, if applicable. The Contractor shall obtain COR/TR approval before uploading any modified or new operating procedure.

C-8.4.4 Workmanship. The Contractor shall ensure that all installation and connections of all equipment shall be in accordance with all applicable codes and standards.

C-8.4.4.1 The Contractor shall ensure that all equipment provided will be arranged or installed as to provide unobstructed access to existing equipment or items requiring maintenance.

C-8.4.4.2 The Contractor shall ensure that all installation projects shall be implemented in a manner that minimizes interference with CPS operations.

C-8.4.5 Acceptance Testing. The Contractor shall provide the COR with all factory acceptance testing documents of equipment prior to installation.

C-8.4.5.1 When specific tests are required, the Government shall provide the Contractor a list of such tests. The Contractor shall prepare a test plan outlining the procedures to be followed for conducting such tests. The Contractor's test plan shall define, at a minimum, each step of the test to be performed in detail, participant responsibilities, documentation for tests, duration of tests, and procedures for dealing with discrepancies and failures during the test.

C-8.4.5.2 The Contractor shall prepare a test report document certifying successful completion of each field acceptance test. The Contractor shall submit these test reports to the COR along with all the required reports as specified in the task SOW.

C-8.4.6 Training. The Contractor shall develop operational procedures and provide appropriate training as required to support new and existing equipment as covered under this contract. In addition to training their own staff, the Contractor shall provide training to various personnel including Government and other GRC support service contractors. The Contractor shall upon request of the COR provide a training report that details the training requirements and training activities of all their employees.

C-8.4.6.1 The Contractor shall document and store all their training records electronically in such a way as to pass spot audits. The Contractor shall be required to submit their training records to the COR upon request.

C-9. CRYOGENIC AND HIGH PRESSURE GAS SYSTEMS OPERATIONS, MAINTENANCE& REPAIR

C-9.1 General. The Contractor shall be responsible for operating, trouble-shooting, and providing watch-standing and inspection duties on various cryogenic devices and systems. The Contractor shall ensure that all operations are conducted with appropriately qualified staff members. Operations include the transfer of various amounts of commodity to and from stationary or mobile high pressure gas and cryogenics systems. Purging of components may also be required. These systems provide hydrogen, oxygen, methane, helium, nitrogen, argon and air in both liquid and gas to users in the Glenn research community both at Lewis Field and Plum Brook Station. The contractor shall be responsible for implementing minor technical solutions which address day-to day operations, the maintenance of components and/or minor system upgrades. Operational activities include the daily monitoring of automated systems and facilities such as verifying pressures, testing for leaks, making adjustments and checking for anomalies. Operations include operating and maintaining relief valve and flex hose testing station(s) and performing relief valve and flex hose certification; some of which includes code stamped components. The flex hose test station will be provided by the Government; a relief-valve test station currently exists, however, the availability to the Contract is currently unknown. Operational activities also include preparation activities required to renew existing and new safety permits, i.e. liquid hydrogen transfer and storage, compressed gas tube trailer systems maintenance, relief valve and flex hose testing.

C-9.2 Personnel Qualification

C-9.2.1 General Qualifications of Cryogenic Personnel. The Contractor shall ensure that all cryogenic technicians have the minimum qualifications as defined by the Department of Labor (DOL) as an engineering technician. Cryogenic Technicians are classified according to skill level and ability in three classifications, as described below. As cryogenics is a specialized field, new personnel are employed primarily as a Cryogenic Technician I (Cryo Tech I) unless prior experience dictates otherwise. A Cryo Tech I may only advance upon successful completion of the conditions for advancement to Tech II.

C-9.2.2 Cryogenic Work Lead (CWL). Supervises the maintenance and operation of stationary and mobile high pressure gas and cryogenic systems that provide hydrogen, oxygen, helium, nitrogen, argon, methane and air in both liquid and gas form to users in the Glenn research community.

C-9.2.2.1 This is the third in a series of three classifications. The CWL is distinguished from the Technician I and Cryogenic Technician II by supervisory and administrative responsibilities in support of the Glenn Research Center's Cryogenics Program. The Cryogenic Work Lead has the responsibility of managing cryogenic and high pressure systems equipment maintenance and repair. The CWL reviews and makes recommendations for the safe filling and transferring procedures for mobile and stationary dewars and other cryogenic and high pressure gas system equipment. The CWL works with the NASA task managers, facility managers, building managers, responsible engineers, the Pressure Systems Office, and the Process Systems Safety Committee to correct discrepancies with cryogenic and high pressure gas systems, components, and equipment.

C-9.2.2.2 Knowledge, Skills and Abilities: The CWL shall have:

- Intimate knowledge of safety concerns associated with cryogenic and high pressure gas systems.
- Intimate knowledge of mobile and stationary cryogenic and high pressure gas systems.
- Knowledge of the physical properties of cryogenic liquids and gases.
- Knowledge of mechanical and electrical principles.
- Knowledge of codes and regulations as they pertain to cryogenic and high pressure gas

systems.
- Training in cryogenics safety
- Training in oxygen and hydrogen safety
- Skilled in the installation, adjustment and repair of mechanical and electrical equipment.
- Skilled in reading, understanding and red-lining piping and instrumentation diagrams (P&IDs) of cryogenic and high pressure gas systems.
- Skilled in supervising and coordinating the work of others.
- Ability to communicate effectively.

C-9.2.3 Cryogenic Tech II (CT2). Performs maintenance and operation of stationary and mobile high pressure gas and cryogenics systems that provide hydrogen, oxygen, helium, nitrogen, argon, methane and air in both liquid and gas form to users in the Glenn research community.

C-9.2.3.1 This is the second in a series of three classifications. The CT2 is distinguished from the Cryogenic Technician 1, by an advanced experience level over that of the Cryogenic Technician I classification. The Cryogenic Technician II has the responsibility of maintaining and repairing cryogenic and high pressure gas systems and equipment. The CT2 reviews and makes recommendations for the safe filling and transferring procedures for mobile and stationary dewars and other cryogenic and high pressure gas equipment.

C-9.2.3.2 Knowledge, Skills and Abilities: The CT2 shall have:
- Intimate knowledge of the safety concerns associated with cryogenic and high pressure gas systems.
- Intimate knowledge of mobile and stationary cryogenic and high pressure gas systems.
- Knowledge of the physical properties of cryogenic liquids and gases.
- Knowledge of mechanical and electrical principles.
- Knowledge of codes and regulations as they pertain to cryogenic and high pressure gas systems.
- Skilled in the installation, adjustment and repair of mechanical and electrical equipment.
- Skilled in reading, understanding and red-lining piping and instrumentation diagrams (P&IDs) of cryogenic and high pressure gas systems.
- Is trained in cryogenic systems safety
- Is trained in oxygen and hydrogen safety

C-9.2.4 Cryogenic Tech I (CT1). A CT1 performs maintenance and operation of stationary and mobile high pressure gas and cryogenics systems that provide hydrogen, oxygen, helium, nitrogen, argon, methane and air in both liquid and gas form to users in the Glenn research community.

C-9.2.4.1 This is the first in a series of three classifications. The CT1 is distinguished from the Cryogenics Technician II, and Cryogenics Work Lead by an entry level type position for experienced mechanics; training in the specialized cryogenics field. The Cryogenics Technician I has the responsibility of maintaining and repairing cryogenic/high pressure gas systems and equipment.

C-9.2.4.2 Knowledge, Skills and Abilities: The CT1 shall have:
- Basic knowledge of the safety concerns associated with cryogenic and high pressure gas systems.
- Basic knowledge of mobile and stationary cryogenic and high pressure gas systems.
- Basic Knowledge of the physical properties of cryogenic liquids and gases.
- Knowledge of mechanical and electrical principles.
- Skilled in the installation, adjustment and repair mechanical and electrical equipment

and compressors.
- Skilled in reading and understanding piping and instrumentation diagrams (P&IDs) of high pressure gas and cryogenic systems.

C-9.3 Base Work Operations

C-9.3.1 Cryogenics Operation Function. The Contractor shall perform operational functions; operate, inspect, adjust, drain, purge, and monitor facilities that contain cryogenic systems.

The Contractor shall perform the duties listed below:

C-9.3.1.1 Check inspect and monitor all automated facilities. Historically, this automated equipment is located at buildings 5, 77, 24, 35 and 301. During periods of liquid hydrogen activity; inspect hydrogen area for leaks and abnormal conditions. Conduct equipment adjustments as necessary.

C-9.3.1.2 Develop/review priority list for scheduled activities for the day, often revised upon completion of daily inspections.

C-9.3.1.3 Building 35 ACS area cylinder pressures are monitored and filled by request of the facility personnel. During periods of continuous operations, daily replenishment is required. The cylinders are refilled utilizing the Cryo Paul Pump. The Paul Pump requires manual start up and shut down with continuous monitoring, equipment adjustments are required during pumping process.

C-9.3.1.4 During periods of liquid hydrogen activity. All mobile equipment associated with the hydrogen activity is monitored, particularly for leaks and proper containment. Liquid levels and vessel pressures are critical indicators and need to be monitored and maintained. Liquid hydrogen transfers are usually conducted on a schedule of every other day. During heavy periods of hydrogen demands, transfers can occur every day. Hydrogen is off loaded from a commercial vender and stored in various mobiles. Transfers then are conducted between various sized mobile Dewars. Liquid hydrogen is ordered as necessary by testing facility personnel.

C-9.3.1.5 Conduct rework of problems areas including non-code compliance that are discovered during recertification and inspections conducted by the Pressure System Office.

C-9.3.1.6 Prepare High Pressure stationary vessels and Cryogenic Dewars for recertification. Provide necessary temporary services during recertification activity.

C-9.3.1.7 Prepare Tube Trailer's for certification which may include transferring, draining, and purging with inert gases. Upon return from recertification facility, trailer components are inspected and sometimes additional repair or component replacement is required. Trailers are prepared for proper commodity which the trailer is designed for which includes: evacuating, purging and pressurizing, placarding, and placing back into service.

C-9.3.1.8 Mobile Dewars and mobile Liquid Vaporizers (LV's) are recertified when required by NASA, on a 5 year cycle. Mobiles are prepped for testing, safety devices are removed and sent to repair facility. Transportation is arranged and the unit is transported to Plum Brook and set up for pneumatic testing. Upon successful completion of pressure testing the Dewar is returned to Glenn. All components are re-inspected, safety devices are installed and a leak check is conducted. Dewar is painted and relabeled as necessary and placed into service.

C-9.3.1.9 Prepare and submit various safety permits and pneumatic test permits. Historically safety permits have included:

- Liquid Hydrogen Transfer and Storage.
- Compressed Gas Tube Trailer System Maintenance.
- Flex hose testing.

C-9.3.1.10 Provide general support for various facilities as requested, i.e. flex hoses, relief valves, fittings, tube trailers, and temporary services for testing, piping and tubing of cryogenic and high pressure gas systems modifications and repairs.

C-9.3.1.11 After completing repairs or testing provide PSO with updated information for entry into the PSD.

C-9.3.1.12 Maintain lock-out tag out log (red lock and non-red locks and tags) of: cryogenic systems, Mobile equipment, high pressure gas systems, tube trailer direct connect systems, and stationary Dewars and vessels.

C-9.4. Base Work Maintenance and Repair

C-9.4.1. Preventative Maintenance (PM) & Repair Requirements. The Contractor shall perform preventive maintenance, programmed maintenance, inspections, and calibrations on all Pressure Vessels and Systems and Cryogenic components and equipment listed in the CMMS and the PSD. The list of Preventative Maintenance Tasks covered under the span of this Contract is located in Section J-C-9.4.1 and in the Technical Reference Library. The Contractor shall as part of its own quality assurance program, randomly inspect the quality of work it performs on at least 10% of the PM tasks it completes per month.

C-9.4.2 PM Scheduling and Documentation. The contractor shall use the Government's CMMS in scheduling and documenting their maintenance and repair activities. The Contractor shall document all pertinent task related data, including the names of the individuals who performed the activity and their labor hours for each task in the CMMS. The Contractor shall update the CMMS within seven days upon completion of any task, or as necessary.

C-9.4.2.1 PM Tasks are generated for Tube Trailers, Mobile Dewars, Stationary Dewars, Mobile LV's, Stationary LV's, Stationary high pressure gas storage vessels, Fuel Trailer relief components, and the Time Capsule. Any discrepancies discovered from the PM inspection are documented and corrected in a timely manner. Major discrepancies are evaluated on a case by case basis and additional work orders are generated to correct the discrepancies.

C-9.4.2.2 PM Tasks are also generated for Recertification of relief valves and flex hoses. Components must be verified with the PSD, scheduled outages are conducted with facility and building managers. Systems are tagged out of service, drained of commodity. The Relief valves are removed and delivered to repair facility for repair, testing and certification. Upon completion of certification, the components are reinstalled and the system is returned to normal service. The contractor shall perform routine repairs that are discovered during daily inspections, trouble calls, and notification by other departments along with PM discrepancies. Historically, most repair needs are discovered during routine maintenance and repair activities.

C-9.4.3 Preventative Maintenance Procedures. PM procedures are defined in the Work Instructions resident in Computerized Maintenance Management System (CMMS), and provided for reference in the Technical Reference Library. The Contractor shall use CMMS to manage its PM program. The Contractor activities shall include updating records, procedures, instruction codes, nameplate data, scheduling, and recommending improvements to GRC's PM program. The data

entered in CMMS becomes the property of the Government. Samples of PM Work Instructions are attached in Section J-C-9.4.3.

C-9.4.3.1. Inherent Reliability Problems. The Contractor shall identify and report to the COR any inherent reliability problems, ineffective maintenance requirements, and ineffective work instructions they uncover and shall make recommendations on how to enhance maintenance approaches.

C-9.4.4 Maintenance Standards. The Contractor shall follow the guidelines set forth in latest edition of NASA NPD 8831.1 Maintenance and Operations of Institutional and Program Facilities and Related Equipment and NPR 8831.2 Facilities Maintenance Management. The Contractor shall recommend additions, deletions, and modifications to the current maintenance activities to the Government;

C-9.4.4.1. All recommendations made by the Contractor shall be cost effective and geared to increase the overall reliability and ensure continuous improvement to the health of the equipment.

C-9.4.4.2. The Government will provide minimal preventative maintenance procedures which will be available in the Technical Reference Library and otherwise will be listed in the Government's Computerized Maintenance Management System (CMMS).

C-9.4.4.3 A copy of the latest version of NASA NPD 8831.1 Maintenance and Operations of Institutional and Program Facilities and Related Equipment (Revalidated June 17, 2013) can be found in (http://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPD&c=8831&s=1E) and a copy of the latest version of NASA NPR 8831.2 Facilities Maintenance and Operations Management can be found in (http://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPR&c=8831&s=2E).

C-9.4.5 Scheduling of Preventive Maintenance Activities. The Contractor shall plan and schedule maintenance work to assure that materials, labor, and equipment are available to complete requirements within the specified time limits and in conformance with established quality standards. The Contractor shall schedule PM, as well as all other types of maintenance and repair work, in such a way as to minimize the impact on the end user. The Contractor shall not perform scheduled maintenance on overtime without approval from the COR. The Contractor shall document a completion date for all PM work on the monthly PM Work Schedule Report and shall complete all scheduled PM's during the period specified in the work order.

C-9.4.5.1 Monthly Preventative Maintenance Work Schedule Report. The Contractor shall provide to the COR a Monthly PM Work Schedule Report, on or about the 20th of each month, that details all Preventive Maintenance tasks completed in the previous month, all backlog PM tasks, and all the PM tasks scheduled for the upcoming month.

C-9.4.6 Scheduling Unplanned Maintenance and Repairs. Unplanned maintenance and repair are equipment problems or malfunctions that occur unexpectedly during the course of the day that require immediate attention by the Contractor to ensure equipment availability to meet the research and test schedule.

C-9.4.6.1 The Contractor shall plan and schedule this unexpected work to assure that materials, labor, and equipment are available to complete repairs within the specified time limits and in conformance with established quality standards.

C-9.4.6.2 The Contractor shall schedule work to minimize interference with the normal occurrence of Government business and mission.

C-9.4.7 Cryogenic Systems Corrective Maintenance and Repair (CSCMR). CSCMR is inherent to equipment and systems maintenance. It includes work identified by the Contractor, or the Government, during the performance of normal maintenance and repair work activities, as necessary to correct problems that would interfere with scheduled operations or to prevent injury to people, equipment or the environment. The Contractor shall inform the COR and other applicable Government personnel when a problem has been identified and corrective action planned. The Contractor shall perform the CSCMR Work Orders on cryogenic systems as defined by the government. These tasks shall include, but are not limited to, material purchases and installations. The Contractor shall create a new work order identifying any CSCMR work they discover utilizing the CMMS.

C-9.4.8 Confined Space Entry Requirements. The Contractor shall follow all NASA, GRC and OSHA confined space entry regulations and prepare confined spaces for entry by others.

C-9.4.9 Relief Valve and Flex Hose Testing. The Contractor shall maintain, inspect, repair, recondition, supply, replace, install, modify, test, and calibrate relief valves. The contractor shall conduct this activity in accordance with the requirements set forth in ASME Section VIII, Div. I, and NBIC NB-23. Relief Valve certification requirements shall include, but are not limited to, relief valve removal, testing, repair, reinstallation, formal documentation, and update of the PSD. Note the contractor is not required to possess VR repair shop accreditation, and may procure commercial VR shop services as required to adjust set point and/or repair code-stamped relief valves. In any case, set point adjustments and repairs to code-stamped relief valves shall only be performed by a shop with VR accreditation.

The contractor shall provide flex hose recertification as required to satisfy agency policy requirements. Flex hose certification varies depending on circumstances, and typically includes: external inspection, internal inspection (special cases), hydrostatic or pneumatic pressure test, formal documentation, and update of PSD.

C-9.4.10 Tube Trailer, Mobile Dewar and Mobile LV Recertification. The Contractor shall manage the refurbishment process of tube trailers, mobile Dewars and mobile LV's to meet the applicable Department of Transportation (DOT) requirements for tube trailer recertification.

C-9.5 IDIQ Tasks

C-9.5.1 IDIQ Tasks. IDIQ tasks are defined as build-up, repair, and testing activities of specific Research RV's and Research cryogenics systems.

C-10. HIGH VOLTAGE SUBSTATION CONTROLS REQUIREMENTS

C-10.1 General. The Contractor shall Maintain, repair and upgrade substation controls and the interfaces to the Central Process Systems Distributed Control (CPSDC) as part of the work scope of this contract.

C-10.2 Base Work Operation. The Operation of the High voltage electrical power distribution is not part of this Contract.

C-10.2.1 Troubleshooting. The Contractor shall provide troubleshooting of High Voltage Substations Control Equipment as part of this Contract.

C-10.3 Base Work Maintenance, Repair and Upgrade. The maintenance, repair and upgrade of the Substation is also not part of this Contract, however, maintenance, repair and upgrade of the substation controls and the interface to the Central Process Systems Distributed Control (CPSDC) is part of this contract.

C-10.3.1 Preventive Maintenance (PM)

C-10.3.1.1 Scheduling of All Maintenance Activities. The Contractor shall document a completion date for all PM work on the monthly PM Work Schedule Report and shall complete all scheduled PM's during the period specified in the work order.

C-10.3.1.2 Monthly Preventative Maintenance Work Schedule Report. The Contractor shall provide to the COR a Monthly PM Work Schedule Report, on or about the 20th of each month, that details all Preventive Maintenance tasks completed in the previous month, all backlog PM tasks, and all the PM tasks scheduled for the upcoming month.

C-10.3.1.3 Preventive Maintenance (PM) Requirements. The maintenance schedule shall accommodate PM procedures as defined in the CMMS database and include routine scheduled items.

C-10.4 IDIQ TASKS

C-10.3.1 IDIQ Tasks. IDIQ tasks are defined as build-up, repair, and testing activities of specific Substation Controls tasks.

C-11. PRESSURIZED VESSELS & PRESSURIZED SYSTEMS (PVS) CERTIFICATION

C-11.1 General Scope of work for PVS Certification. Certification of PVS includes review of existing documentation, preparation for inspection, visual and non-destructive examinations, engineering evaluation, formal risk assessment, recommendations to meet Fit-For Service requirements, supporting documentation/reports as detailed below, and approval by the Pressure Systems Manager. Actual repairs necessary to meet Fit-For Service requirements are also part of the certification process, but are frequently initiated as a separate IDIQ task, and may be completed by others. The Contractor shall review all related existing documentation, generate new drawings if required, make all necessary preparations for inspection, perform all visual and non-destructive examinations, conduct all engineering evaluations, develop risk assessment documentation, develop a statement of work for repairs (if applicable), and submit documentation to PSM for certification approval. Upon completion of any repairs, the contractor shall review and approve all supporting documentation involved with the repairs. The contractor shall be responsible for periodic in-service inspections and shall be responsible for maintaining accuracy of the pressure systems database. Certification is defined as all activities including recertification, repairs, documentation, PSM approval, and periodic in-service inspections. Detail on the type and number of PVS to be certified is contained in section 2.7

C-11.2 Personnel Qualifications

C-11.2.1 General Personnel Requirements. Safety is of paramount importance in all issues related to the activities covered under this SOW. Due to high pressure and/or temperatures, as well as cryogenic conditions, knowledge of, and strict adherence to, NASA, GRC, ASME, ANSI, DOT and other applicable national codes and standards is imperative. The Contractor shall ensure that personnel performing this work possess a comprehensive understanding of their duties and all applicable codes and standards. The Contract shall provide a report to the COR that provides proof of certification and qualifications of their employees who perform PV/S certification work. The proof of certification and qualifications report is due 15 days after Contract start date, then on the 1st day of every September and March. See Section J-C-11.2.1 for further general personnel requirements details. The following specialized skills will be required to perform pressure system certification.

C-11.2.1.1 Key Personnel. Key Personnel are defined as the group of individuals responsible for the management of the contract. The Contractor's key personnel shall be; full time employees, solely dedicated to the implementation of this contract, and be permanently stationed at GRC.

C-11.2.1.2. Critical Personnel. Critical personnel are defined as the technical individuals required for the successful technical execution of the task. The Contractor's critical personnel shall be; full time employees, solely dedicated to the implementation of this contract, and be permanently stationed at GRC.

C-11.2.2 Pressure Systems Engineers (PSE)

C-11.2.2.1 Chief Principal Pressure System Engineer (PSE). Completion of a ABET accredited engineering degree, requiring four or more years of full-time study. Experienced in overseeing and managing fitness-for-service analysis, inspection and failure analysis, or design, evaluation, construction, repair, and operation of pressure vessels, piping and tanks in the cryogenic/gas, aerospace, chemical, nuclear, refining and/or petrochemical industry.

C-11.2.2.2 Principal PSE. Completion of a ABET accredited engineering degree, requiring four or more years of full-time study. Experienced in fitness-for-service analysis, inspection and failure analysis, or design, evaluation, construction, repair, and operation of pressure vessels,

piping and tanks in the cryogenic/gas, aerospace, chemical, nuclear, refining and/or petrochemical industry. The Contractor's Principal PSEs shall be a registered Professional Engineers.

C-11.2.2.3 Senior PSE. Completion of a ABET accredited engineering degree, requiring four or more years of full-time study. Experienced in fitness-for-service analysis, inspection and failure analysis, or design, evaluation, construction, repair, and operation of pressure vessels, piping and tanks in the cryogenic/gas, aerospace, chemical, nuclear, refining and/or petrochemical industry. Senior PSEs should be registered Professional Engineers

C-11.2.2.4 PSE. Completion of a ABET accredited engineering degree, requiring four or more years of full-time study, some experience in fitness-for-service analysis, inspection and failure analysis, or design, evaluation, construction, repair, and operation of pressure vessels, piping and tanks in the cryogenic/gas, aerospace, chemical, nuclear, refining and/or petrochemical industry. Formal classroom training in the following courses is highly recommended for practicing PSEs: ASME B&PV Section VIII Div 1 and 2, ASME B31.3, ASME / NBIC NB-23, API RP-579, and API RP-520.

C-11.2.3 Inspectors, Examiners and Draftsman

C-11.2.3.1 NDE Level III Technician. Completion of related classroom training in accordance with ASNT SNT-TC-1A, plus experience in the inspection and examination of pressure vessels, piping and tanks in the cryogenic/gas aerospace, chemical, nuclear, refining and/or petrochemical industry; and ASNT certification to perform visual, leak testing, liquid penetrant, magnetic particle, radiography, ultrasonic shearwave, and ultrasonic thickness testing.

C-11.2.3.2 Senior NDE Technician (NDE Level II). Completion of related classroom training in accordance with ASNT SNT-TC-1A, plus experience in the inspection and examination of pressure vessels, piping and tanks in the cryogenic/gas aerospace, chemical, nuclear, refining and/or petrochemical industry; and ASNT certification to perform visual, leak testing, liquid penetrant, magnetic particle, radiography, ultrasonic shearwave, and ultrasonic thickness testing.

C-11.2.3.3 NDE Technician (Examiners). Completion of related classroom training and work experience in accordance with ASNT SNT-TC-1A, as detailed in the chart in Section J-C-11.2.3.3.

C. 11.2.3.4 Draftsman DRAFTER/CAD OPERATOR IV. This person works closely with design with Pressure Systems engineers and Technicians preparing drawings or computer models of Pressure Systems and components found throughout GRC's Lewis Field and Plum Brook Station. See Attachment E in Section J for further details.

C-11.3 Base Work Requirements

C-11.3.1 Pressurized Systems Certifications Process. The following paragraphs are provided for reference on how the certification process is currently conducted and the minimum qualifications of the key personnel involved. The qualifications of personnel are located within this section. The Contractor shall perform all PV/S certifications as described in the following chart. The technical certification personnel shall be comprised of Pressure Systems Engineers, Inspectors & Examiners and Drafters as described within this section.

C-11.3.1.1 Certification Process and Flowcharts. The current certification process, including flowcharts, is attached in see Section J-C-11.3.1.

C-11.3.2 Certification Services. The Contractor shall determine the requirements necessary for the certification of systems and or components by interpreting the NASA requirements documents and applicable national codes and standards. Specific NASA policy documents specifying certification requirements are NPD-8710.5, "Policy for Pressure Vessels and Pressurized Systems", and STD-8719.17, NASA Requirements for Ground-Based Pressure Vessels and Pressurized Systems". The Contractor shall be responsible for determining what equipment needs certification and how best to certify at minimum cost.

C-11.3.3 Certification Tasks. For each specific certification task, the Contractor shall; review all related existing documentation, generate new drawings if required, make all necessary preparations for inspection, perform all visual and non-destructive examinations, conduct all engineering evaluations, develop risk assessment documentation, develop a statement of work for repairs, and upon completion of the repairs, review and approve all supporting documentation involved with the repairs. The Contractor shall use qualified engineers and technicians in the performance of certification work. There are five major steps used in the certification process at GRC, they are outlined below.

C-11.3.3.1 Documentation retrieval and review. The Contractor shall gather existing documentation (or create new documentation in some cases) and other information that is necessary in performing the certification to the current standards. These documents shall include, but are not limited to, the design drawings, materials identification, fabrication information, NDE records, code/design calculations and engineering analysis, code certification data, etc. The Contractor shall establish appropriate recertification files and PSD/CMMS data to provide a permanent recertification record that includes all follow-on In Service Inspection (ISI) requirements.

C-11.3.3.2 Initial Engineering Assessment. The Contractor shall review existing documentation to identify and determine the adequacy of the pressure system components with respect to the NASA requirements and current codes and standards. This includes review of maximum allowable working pressure and temperature, remaining life evaluation, etc. In most cases, simple code calculations or evaluations using commercial codes are adequate. However, in some cases a finite element analysis, and/or fatigue and fracture life assessment may be required. The Contractor shall have demonstrated capabilities to perform all type of engineering assessment; and in addition to the above calculations, shall provide relief valve sizing calculations and piping system flexibility analyses of piping systems, as required.

C-11.3.3.3 Determination of Conditions and Identification of Defects. The Contractor shall determine the best suitable method to evaluate the current condition of the pressure systems and components based on the code requirements, risk assessments, and cost considerations. This will require review of past operating history, operating conditions, understanding of possible damage mechanisms and review of past in service inspection records. The Contractor shall, based on this evaluation, determine and specify non-destructive examination (NDE) requirements for systems and components.

C-11.3.3.4 NDE Evaluation. The contractor shall perform NDE based on the above determination and document all findings. The Contractor shall be capable of providing all types of NDE testing, including visual examination, liquid penetrant examination, magnetic particle examination, radiographic examination, ultrasonic examination, ultrasonic thickness testing, eddy current inspection, hardness testing, acoustic emission examination, positive material identification and replication testing.

C-11.3.3.5 Final Engineering, Evaluation and Recommendations. The Contractor shall, based on the results of the NDE evaluation, determine the current condition of the pressure

system and all of its components and shall update all preliminary calculations to reflect the current conditions. The Contractor shall establish required corrective actions (repairs), depth and schedule of future in-service inspections (ISI), re-certification schedule, operating restrictions if any and re-rating or de-rating required prior to releasing the system for operation. In many cases, there are choices between making modifications and performing detailed engineering evaluation using ASME section VIII, Div II and finite element analysis. The contractor shall make the recommendation.

C-11.3.3.6 Risk Assessment. The Contractor shall perform a Risk Analysis and establish risk assessment code determinations based on NASA standard 8719.17. See J-C-11.3.3.6 for detail on risk assessment procedure.

C-11.3.3.7 Certification Report. The Contractor shall prepare initial certification reports documenting results of all the steps outlined above for approval by the PSM. The Contractor shall provide the COR a completed Certification Report thirty (30) calendar days after the task completion. The contractor shall also upload final certification documents to the CMMS within thirty (30) calendar days after the task completion. These documents shall minimally include Certification certificate, formal RAC statement, NDE reports, and pertinent calculations. A copy of the report shall be placed in the Technical Library.

C-11.3.4 In-Service Inspection. The Contractor shall perform scheduled inspections in accordance with in-service inspection requirements identified in the data books, PSD, and CMMS for those pressure systems, vessels, and components that have been certified and are currently being used. The Contractor shall include post inspection reports and documentation to reflect inspection completion and recommended future inspection actions and requirements. The Contractor shall update as necessary the data books, databases, and drawings.

C-11.3.5 Database Maintenance and Updates. The Contractor shall identify systems and components through tagging, bar coding, and documentation utilizing the PSD and CMMS. The Contractor shall document all recertification work, results, and recommendations in recertification data books, PSD, and CMMS. The Contractor shall complete all documentation updates thirty (30) calendar days after the task is completed.

C-11.3.6 Certification Repairs and Analyses. The Contractor shall have capabilities to make required modifications to existing PV/S and make engineering assessments of the modified PV/S. The Contractor may use in-house staff or outside qualified (sub) contractors as appropriate. Government approval is required before any repairs are done. The Contractor shall follow all FAR requirements when subcontracting repair efforts; as a minimum the Contractor shall acquire three independent bids when the cost of the repairs are expected to exceed $3,000. The Contractor shall oversee, manage and perform all applicable assessments and analysis on all repair efforts that they implement. The Contractor shall ensure all modifications meet the current code requirements and all modifications be made using code certified welders, welding procedures and NASA safety procedures. The Government reserves the right to make repairs using other contractors. When this happens the Contractor shall not have any involvement or responsibility in these repairs except for final inspection and documenting into the PSD.

C-11.3.7 Owners Inspection Services. The Contractor shall have capabilities of providing Owner Inspection services to assure code compliant construction as needed on government construction projects. The Contractor may use in-house staff or outside qualified (sub) contractors as appropriate. In this function, the contractor shall provide staff to act as the Governments Owner Inspector to assure compliance with ASME B31 series Piping Codes and ASME Section VIII Boiler and Pressure Vessel Code. The qualifications and responsibilities of Owner Inspectors are identified in respective ASME codes.

C-11.4. IDIQ Requirements

C-11.4.1 IDIQ Tasks. This includes, but is not limited to major finite element analysis, flexibility analysis and design for hardware modifications for the GRC LF & PBS Pressurized Vessels & Systems.

C-12. HEALTH, SAFETY AND ENVIRONMENTAL

C-12.1 General. The Contractor shall utilize proactive and innovative safety practices on a continual basis throughout the contract period. The Contractor's Safety and Health Program shall comply with Occupational Safety and Health Administration (OSHA) Regulations and the GRC Safety & Mission Assurance (SMA) Requirements which are defined in the Glenn Safety Manual (see General Library for GLM QS 1700.1) and the Glenn Occupational Health Programs Manual (see General Library for GLM-QS-1800.1).

C-12.2 Personnel Requirements. The Contractor's personnel and subcontractors shall only perform work for which they are specifically trained. In addition, the Contractor's staff shall maintain a safe and clean worksite and report all incidents and near-misses to Contractor supervisors. The Contractor shall implement an effective job hazard analysis program to document, control, and communicate hazards identified during the execution of tasks performed under this SOW.

C-12.2.1 Requirements for Safety Personnel. The Contractor shall have on-site Safety and Health Key Person as part of their Safety & Health function within 30 days from the contract award date. A qualified safety and health professional is defined as an individual having at least one of the following industry-recognized safety certifications:

C-12.2.1.1 Certified Safety Professional (CSP)

C-12.2.1.2 Certified Industrial Hygienist (CIH)

C-12.2.1.3 Bachelor's or Associate's degree in safety, industrial hygiene, engineering, or in a related field with at least ten (10) years of full-time safety and health experience.

C-12.3 Safety Inspections & Plans. The Contactor shall conduct and document periodic safety and health inspections of all job sites, tasks, and work activities. All findings from these inspections shall be documented and addressed utilizing a closed loop corrective action process and be available to the Government for review.

The Contractor shall provide an initial draft of their GRC Site-Specific Health and Safety Plan (HASP) 15 business days after the contract award date that covers operations, recurring maintenance and IDIQ activities. The GRC Site-Specific Health and Safety Plan shall comply with all GRC health, safety and environmental requirements and the requirements of the Occupational Safety Health Administration (OSHA). Specifically, the plan shall identify the methods and procedures that will be used to ensure a safe and healthful work environment and the methods the Contractor will use to protect both Contractor employees, GRC employees and the environment. The Contractor shall assume safety responsibilities in all subcontracts and shall monitor their subcontractors' activities to ensure compliance with the approved health and safety plan.

The Government will review the draft HASP submittal and provide comments back to the Contractor. The Contractor shall revise the plan and resubmit for final approval within 10 working days. Upon the Government's approval of the final plan, the Contractor shall schedule a conference between the Government, the Contractor's safety personnel, and any subcontractors to ensure mutual understandings of the Contractor's approved GRC Site-Specific HASP. This conference shall occur no later than thirty (30) days after contract award.

IDIQ Task Specific HASPs shall be provided for specified non-recurring activities where unique hazards are identified and require mitigation and/or control (not covered under the GRC Site-Specific HASP. Attachment J-C-12.3 contains the requirements for a typical IDIQ Task Specific HASP). GRC Site-specific HASPs are not required when Contractor employees are performing a job hazard analysis of a workplace condition prior to the actual start of the work or after all the work has been completed (typically covered under the GRC Site-Specific HASP).

C-12.4 Safety Equipment. The Contractor shall provide their employees all safety equipment necessary to meet the requirements of OSHA and all elements of this SOW. Equipment covered under these requirements includes, but is not limited to, work platforms, trailers, basket trucks, cranes, slings, pressure vessels and hoses, boilers, transformers, switchgear, chillers, generators, and meters. The Contractor shall ensure the all their equipment be calibrated as recommended by the manufacturer and inspected before each use by trained and competent employees Costs for safety equipment and calibration shall be included under the Base portion of the contract.

C-12.5 Personal Protective Equipment (PPE). The Contractor shall provide PPE for all personnel assigned to this contract. PPE shall include, but not limited to, fall protection equipment, disposable protective clothing, respiratory protection, hearing protection, eye protection, head protection, face protection, hand protection, high visibility clothing, and electrical safety clothing. Costs for PPE and the associated training for the use of PPE shall be included under the Base portion of this contract.

C-12.6 Work Area Access. The Contractor shall coordinate with the COR all operations that involve safe access to hazardous work areas, shutdowns of mechanical, electrical and controls equipment, shutdown of utilities, and shutdown of all on-going research testing. For hazardous operations, the Contractor shall define hazard areas and exclusion zones that protect participating and non-participating personnel in the event of a mishap. The Contractor shall establish and implement personnel limits in areas where hazardous operations occur. The Contractor shall also control access into these areas during the execution of hazardous operations and shall ensure that only active, essential personnel are in these areas during hazardous operations.

The GRC Safety Manual provides guidance for establishing exclusion zones and requirements for safe operations in hazardous locations.

C-12.7 Standard Forms & Procedures. The Contractor shall complete standard GRC forms and comply with established operation procedures as required. These forms and procedures are listed below, and can be found in Attachment J-C-12.7:

C-12.7.1 Hot Work Authorization Permit (Standard Form C-7A)

C-12.7.2 Hot Work Pre-Operations Checklist (Standard Form C-7B)

C-12.7.3 Confined Space Entry Permit (Standard Forms C-199, C-199B & C-199C)

C-12.7.4 Impairment Plan, Fire Protection (Standard Form C-316)

C-12.7.5 Lock-Out Tag-Out Procedures (Standard Form C-787C&D)

C-12.7.6 GRC Safety Permit (Standard Form C-919)

C-12.7.7 GRC Safety Permit Request (Standard Form C-923)

C-12.7.8 Digging, Trenching, and Excavating Permit (Standard Form C-927)

C-12.7.9 Security Forms, Badge Application (Standard Form C-969A)

C-12.7.10 Area Clearance Authorization (Standard Form C-978)

C-12.7.11 Fall Prevention Plan* (Standard Form C-979)

C-12.7.12 Critical Lift Determination (Standard Form C-195)

C-12.7.13 Pneumatic Test Request (GRC 802)

C-12.7.14 Pneumatic Test Permit (GRC 804)

C-12.7.15 Pressure Vessel Pneumatic Test Checklist (GRC 4026)

C-12.7.16 Pressure Vessel Pneumatic Test Report (GRC 4010)

C-12.7.17 Piping System Pneumatic Test Checklist (GRC 4020)

C-12.7.18 Piping System Pneumatic Test Report (GRC 4014)

C-12.7.19 Weld Request Form (GRC 4025)

C-12.7.20 Pressure Vessel Hydrostatic Test Checklist (GRC 4022)

C-12.7.21 Pressure Vessel Hydrostatic Test Report (GRC 4016)

C-12.7.22 Piping System Hydrostatic Test Checklist (GRC 4018)

C-12.7.23 Piping System Hydrostatic Test Report (GRC 4012)

C-12.7.24 Pressure Relief Device On-Stream Functional Test Report (GRC 4030)

C-12.7.25 Pressure Relief Device Non-Code Maintenance Record (GRC 4031)

(*Note: NASA Procedural Requirement (NPR) 8715.3 requires all contractors wearing fall protection equipment to have a competent person develop the fall prevention plans. The Contractor's competent person must have fall protection competent person training from an industry recognized source)

C-12.8 Support for GRC Safety, Health, and Environmental Audits. The Contractor shall provide qualified and competent personnel to support all regulatory audits, inspections, and assessments for work and tasks identified in this SOW. Typical audits include GRC and Agency Office of Safety and Mission Assurance (OSMA) audits and inspections, NASA Institutional Facilities & Operations (IFO) SMA Audits, OCHMO reviews, OSHA Inspections, and Ohio EPA Inspections and Audits. The IFO Audit is scheduled every four years, but the frequency of the other audits is typically unknown. The Contractor shall, by utilizing a closed-loop corrective action process, document, address and correct all specific finds or violations generated by audits. The Contractor shall provide the Government with a monthly status of all corrective actions associated with findings or violations generated through the audits.

C-12.9 Training. The Contractor shall ensure that all employees receive required training that meets regulatory requirements in accordance with current GRC, OSHA, EPA and other applicable federal, state, or local regulatory agency standards**.** The Contractor shall maintain a safety and environmental training database for all its employees. The Contractor's data base shall include, as a minimum, name of employee, position or title, required or unique training, certifications, licenses and status (i.e. completion and expiration dates). At all times, this database shall be immediately available for review upon request by the Government.

C-12.10 Safety Reporting. The Contractor shall report all accidents, including near misses, to the COR using the NASA Mishap Information System (NMIS) and shall initiate an investigation within twenty-four (24) hours in accordance with the Glenn Safety Manual, Chapter 21, Mishap and Close Call Reporting, Investigating, and Recordkeeping. The Contractor shall provide an annual OSHA 300A log (not including names or personal identification information). The contractor shall conform to the new OSHA Recordkeeping Rule for Reporting Fatalities and Severe Injuries effective Jan. 1, 2015.

C-12.11 Environmental Compliance.

C-12.11.1 Environmental Protection and Policies. The Contractor shall comply with all applicable Federal, State, and local environmental laws and regulations and all policies and standards listed in the GRC Environmental Programs Manual shown in Appendix J-C-12.11. The contractors shall contact COR and the appropriate person within Code FE, the Environmental Management Office for the clarification of any activities that could have an environmental impact. The Contractor shall provide any data needed to support environmental permits when requested by the cognizant GRC FE representative. All environmental protection matters shall be coordinated with the COR and the representative from Code FE, the Energy and Environmental Office. Support from the existing environmental support contract may be utilized for environmental related tasks using Work Requests. The Contractor shall maintain current environmental records and training records for facilities operated by the Contractor. The Contractor shall maintain a list detailing when their

employees have completed environmental related training. The Government or individual(s) authorized by the Government may inspect these records/facilities, at any time without notice. Sustainability, waste reduction, and recycling data required by environmental policy (?) shall be reported to the COR which will be relayed to Code FE Environmental Management Office. In the event that a regulatory agency assesses a monetary fine or penalty against the Government for violations which directly result from performance by the Contractor in carrying out their responsibilities under this contract, the Contractor shall reimburse the Government for the amount of that fine or penalty and other related costs incurred by the Government. Any such reimbursement shall be accomplished by a contract credit. The Contractor shall use certified personnel, coordinated with and/or approved by GRC FE, to clean up any environmental spills that result from the Contractor's performance. If hazardous waste or material is spilled, the Contractor shall respond according to the Center's Emergency Preparedness Plan (EPP – Note this document is Sensitive But Unclassified (SBU) and only provided through a request to the GRC Emergency Management Coordinator). In the event of a sizable spill, the Contractor shall follow Incident Commander Direction. The Contractor shall comply with the instructions of the cognizant GRC FE with respect to avoidance of conditions which create a nuisance or which may be hazardous to the health and safety of on-site personnel. The Contractor shall observe and adhere to all requirements for handling and storage of combustible supplies, materials, waste, and trash. Any oils and lubricants resulting from work of the Contractor (i.e., PM), including those removed from Government owned equipment, shall be disposed of in accordance with GRC instructions. GRC FE shall be contacted before any equipment holding environmental permits is modified, renovated or removed.

Technicians that handle refrigerants are required to have the appropriate EPA Section 608 Technician Certification. Refrigerant venting is not allowed. It is GRC Policy to use only non-ozone depleting substances and to not operate equipment leaking refrigerants. Any exemptions require a waiver from the GRC Code FE Environmental Management Office. Contact/notify/consult with GRC Waste Management before any venting of any containerized gasses.

C-12.11.1.1 Requirements for Asbestos Containing Material (ACM). The Contractor shall have either an in-house capability or a subcontracted capability with a licensed asbestos abatement firm to perform asbestos abatement for maintenance activities to include abatement, sampling, removal, and third party inspection. In addition, all Contractor employees shall have Asbestos Awareness Training with an annual refresher. Asbestos Awareness Training is offered at GRC and Contractor attendance is dependent upon availability of seats. At no time shall existing building materials be disturbed or impacted without being assessed for asbestos content. All existing materials shall be assumed to be asbestos-containing until proven otherwise by sampling and analysis. The Government will provide the Contractor with any existing bulk asbestos sampling and analysis data for determining the asbestos content of an unknown material. If the existing data is insufficient, the contractor will be required to provide further sampling and analysis.

Only Ohio Department of Health (ODH) licensed Asbestos Hazard Abatement workers shall handle or remove ACM in any quantity. In addition, all asbestos abatement work shall be supervised by a competent person licensed by the Ohio Department of Health (ODH) as an Asbestos Hazard Abatement Specialist. All certification/licensing records are to be readily available for inspection.

Small scale-short duration asbestos tasks must be added to the center's Asbestos Blanket Permit **prior to** work task implementation. The Permit is maintained by SHeD.

GRC maintains an active database called the Facility Asbestos Survey System (FASS). This database contains ACM sampling data for every property at the Center. The Contractor can access the FASS using the GRC intranet.

C-12.11.1.1.1 Federal Regulations. All asbestos abatement work shall be performed in accordance with the following Federal Regulations:

C-12.11.1.1.1.1 OSHA 29 CFR 1926.1101

C-12.11.1.1.1.2 US Environmental Protection Agency (USEPA) National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Part 61

C-12.11.1.1.2 State of Ohio Regulations. All asbestos abatement work shall be performed in accordance with the following State of Ohio Regulations:

C-12.11.1.1.2.1 Ohio Department of Health (ODH) OAC 3701-34

C-12.11.1.2 Requirements for Managing Lead-Based Materials. Onsite support service contractors and construction contractors are responsible for developing and implementing their own lead compliance programs in accordance with OSHA and NASA requirements. All Contractor employees shall have GRC Lead Awareness Training with an annual refresher. Lead Awareness Training is offered at GRC. At no time shall paints or sealers be disturbed or impacted without being assessed for lead content. All existing paints and sealers shall be assumed to be lead-containing until proven otherwise by sampling and analysis or by direction of the COR. The Government will provide the Contractor with any existing lead sampling and analysis data for determining lead content of an unknown material. If the existing data is insufficient, the contractor will be required to provide further sampling and analysis.

Only Contractor employees having appropriate Safety, Lead hazard abatement specific training and Resource Conservation & Recovery Act (RCRA) Work Methods Training (provided by GRC) shall handle, remove, or dispose of lead-based materials. All such work shall be performed in accordance to GRC Local Specification 02 83 00.98 Lead Paint Abatement. See Attachment J-C8.2 for specification. Workers removing lead-based materials shall use respiratory protection as required in this specification.

C-12.11.1.3 Requirements for Managing Hazardous or Solid Waste Soils. Requirements for Managing Hazardous or Solid Waste Soils. At no time shall any soils be disturbed, relocated, or removed from GRC Lewis Field without the soils being assessed for solid or hazardous waste content and the approval of the COR. Any areas of soil disturbance shall also include the use of Municipal Separate Storm Sewer System (MS4) Best Management Practices (BMP) and depending on area of disturbance the Contractor may be required to obtain an Ohio EPA-permit. The Government will provide the Soil Determination. If sufficient data exists to characterize the soils the government will provide the data. If there is insufficient data to characterize the area the contractor shall provide the additional sampling and analysis data to complete the Soil Determination.

If the Contractor uses Sub-Contracted Services in the excavation of solid or hazardous waste soils, a responsible individual shall have completed the forty (40) hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training. HAZWOPER Training is offered at GRC and Contractor attendance is dependent upon availability of seats. The requirements for soil excavation include:

C-12.11.1.3.1 The Contractor shall not stockpile hazardous or solid waste soil. Waste soils shall be placed directly into lined containers for disposal. Any disposal shall be coordinated with the COR and the GRC Waste Management and Disposal contractor.

C-12.11.1.3.2 Hazardous or solid waste soils shall never be placed back into an excavation.

C-12.11.1.3.3 Requirements for the handling of contaminated soils are covered in GRC Local Specification 02 61 00.98 Removal and Disposal of Contaminated Soils. See Attachment J-C-12.11.1.3.3 for specification.

C-12.11.1.3.4 The onsite reuse or relocation of clean non-contaminated soils must be coordinated through the Government. The offsite reuse or disposal of non-contaminated soils will be coordinated through GRC Waste Management.

C-12.11.1.4 Accidental Spills of Chemical Substances. GRC requires an immediate response to all accidental spills of chemical substances regardless of the volume of the spilled material. In the event of a spill, the Contractor's staff shall call the GRC Dispatch Office at 911 (from an internal phone) or when using a cellphone at Lewis Field (216) 433-8888 or when at Plum Brook Station (419) 621-3222. If possible, the caller shall inform the Dispatcher of the identity and volume of the material spilled.

The Contractor shall supply and maintain a variety of spill kits that are approved by the Government. These kits shall include provisions for spills in both interior and exterior spaces. In addition, the Contractor's staff will be required to receive Spill Countermeasures and Control Plan (SCCP) annual training provided by the GRC Training Organization. All spills shall be documented on a Spill Occurrence Report, and provided to the COR. The Contractor shall also work with the COR to complete a NASA Mishap Information system (NMIS) Report.

For small spills of nontoxic, nonflammable materials (one gallon or less), the Contractor's staff shall attempt to contain and clean up the material with the approved spill kit. For large spills of nontoxic, nonflammable materials inside buildings, the Contractor shall take immediate action to contain the spill through the use of absorbent materials and drain covers to stop the flow prior to entering the environment. For spills of this nature in outdoor areas, the Contractor shall use absorbent booms and pads to prevent the materials from entering storm sewer catch basins or areas containing large amounts of surface water. In all cases, the Contractor's staff shall remain on site until the GRC Emergency Response Team (ERT) arrives to provide technical information to the incident commander.

If the spilled material is a flammable or toxic substance, the Contractor's staff shall immediately notify the Fire Dispatch, evacuate the area and establish a safe zone around the spill. Cleanup activities of this nature shall be performed only by ERT personnel who are trained in the handling of flammable and/or toxic materials.

Upon containment and cleanup of the spill, the Contractor shall work with the COR to dispose of the saturated absorbent materials through the GRC Waste Management and Disposal Contract.

There shall be adequate spill kit materials available when recertifying fuel and oil systems to contain spills and protect sewer inlets.

C-12.11.1.5 Standard Forms & Procedures. The Contractor shall complete standard GRC forms and comply with established operation procedures. These forms and procedures are listed below, and can be found in Attachment J-9.

C-12.11.1.5.1 Waste Disposal Request (available on GRC Intranet)

C-12.11.1.5.2 Soil Relocation and Authorization Form (available on GRC Intranet)

C-12.11.1.5.3 Spill Occurrence Report (available on GRC Intranet)

C-12.11.1.5.4 NASA Mishap Information system (NMIS) Report (available on GRC Intranet)

C-12.12 Lockout/Tagout (LO/TO). The Contractor shall provide all LO/TO service in support of the Contractor's own work. In addition the Contractor shall provide isolation service on CPS equipment for work to be done by others and provide access to and explanation of how the isolation has been accomplished so that LO/TO can be applied by the personnel performing the task. GRC-946a Danger (LO/TO) tags shall be provided to other performing contractors, to be used, in order to be compliant with the Glenn Safety Manual.

C-12.12.1 Qualified LO/TO Personnel. Within fifteen (15) calendar days after Contract Start Date, and as requested by the COR, the Contractor shall provide the COR a listing of all employees and their LO/TO roles, responsibilities, qualification and titles, including but not limited to: Area Supervisor(s), Authorized Employee(s), and personnel qualified to perform electrical high and/or low voltage, or mechanical switching and energy isolation of systems related to the CPS as a result of the LO/TO activity.

C-12.13 Software Lockout/Tagout (LO/TO). The Contractor shall place and remove operator console "screen tags" on all components associated within their area of control when LO/TO activities dictate. The Contractor shall "Out-of Service" (OOS) all points that provide nuisance alarms to the Operators.

C-12.14 Confined Space Entry Requirements. The Contractor shall follow all NASA, GRC and OSHA confined space entry regulations and prepare confined spaces for entry by others.

C-12.15 System Outages.

C-12.15.1 Planned System Outages. When planned maintenance or repair requires a break or reduction in services, the Contractor shall make the following notifications for all activities performed under this contract requiring system or building outages, the Contractor shall provide advance notice to the COR, affected BM, SM, TR, PM (if applicable) and FM. A list of FM or customers for each facility will be provided by the Government upon request. Customer notification shall include the length of time and type of work to be performed. Should work progress temporarily halt before job completion, the Contractor shall provide the customer with the reason for delay and the projected date or time they shall return to complete the work. The COR will make every attempt to approve the requested outage; however, as a general rule priority is given to scheduled research activities. The Contractor shall fully cooperate with other contractors and Government employees and shall carefully adapt scheduling and performance of work under this contract to accommodate the work by others.

C-12.15.2 Area Clearance. The Contractor shall execute an "Area Clearance Authorization" request that shall provide, as a minimum, the following specifications or information to the affected individuals: the equipment or system involved; reason for the outage; date and time the Contractor would like the outage to occur: and an estimate of when normal services are to be resumed. A sample Area Clearance is shown in Section J-C-12.15.2.

C-12.16 Hardwire Shutdown Verifications & Calibrations. The Contractor shall verify the Hardwire Shutdowns and Calibrations on any system or piece of equipment which has been taken out of service for major repair or rehabilitation or has been replaced due to component failure or wear.

C-12.17 Safety Permit Documentation and Support. The Contractor shall assemble and submit required documentation for safety approvals and/or permits. The contractor shall use the safety permit request, permit renewal, or modification process using the safety permit website (https://safetypermit.grc.nasa.gov). Within fourteen (14) calendar days after the start of the contract, the Contractor shall review and update the information in all CPS related Safety permits. A list of CPS related Safety Permits is provided in Section J-C-12.17.

C-12.17.1 Annual Documentation. The Contractor shall prepare and submit annual documentation necessary for submittal to the NASA GRC Electrical Applications and/or Process Systems Safety Committees as part of the permit renewal request process. An example is provided in Section J-C-12.17.1. This shall include notification of all procedural changes being considered, reporting on significant irregularities that impact safety, listing of qualified operators, hosting and conducting walk-through inspections by the safety committee membership, answering specific questions posed by safety committee members verbally and in written form.

C-12.18 Hearing conservation. OHPM Chapter 3-The contractor with employees who may be working on tasks where the noise exposure levels may equal or exceed the NASA action level of 82 decibels, A-weighted scale (dBA), are required to have their own site-specific, written Hearing Conservation

Program that meets Federal, state, and NASA requirements. Contractor HCPs shall be developed in accordance with NASA Federal Acquisition Regulation (FAR) Supplement 1852.223–70, Safety and Health, and shall incorporate the full intent of the OHPM Chapter 3. Employers shall ensure employees comply with all program requirements including noise hazard assessments, training, personal protective equipment, medical surveillance, NASA Buy-Quiet/Quiet-by-Design, and other requirements as needed, to ensure compliance with NASA policy.

Construction contracts require the submission of a health and safety plan per NASA FAR supplement 1852.223–73 and also require compliance with NASA FAR supplement 1852.223–70. NASA FAR supplement 1823.7001 provides the guidance as to when the 1852.223–70 is required. Construction contractors and all other visitors shall abide by the personal hearing protection requirements and noise exposure limits, as specified in this chapter, by observing and complying with all posted hearing protection requirements.

Implement GRC Buy-Quiet/Quiet-by-Design protocols as specified in the OHPM Chapter 3

Equipment expected to produce noise that approaches hearing conservation levels of 80 dBA and higher, under a variety of site and operational considerations shall be subject to a Buy-Quiet/Quiet-by-Design analysis during the design phase or prior to purchase.

C-12.19 Respiratory Protection. OHPM Chapter 4- The contractor with employees using respiratory protection equipment shall have a written Respiratory Protection Program, as required by OSHA, and shall ensure employees comply with their program requirements including medical clearance training, respirator fit tests, proper use and maintenance of respiratory protection equipment, and any other requirements as set forth in OHPM Chapter 4.

Mercury: OHPM Chapter 6-Contractors working at the GRC and PBS facilities are required to follow GRC operational procedures to protect NASA property and equipment. Contractors are required to have their own policies to protect employee health for potential exposure to mercury.

Local exhaust ventilation (LEV)- OHPM Chapter 7

The contractor shall operate LEV systems in accordance with OHPM Chapter 7

C-12.20 Radiation Protection for Radioactive Materials- OHPM Chapter 8. The contractor shall conform to the requirements, basic procedures, and radiation protection requirements for the receipt, use, storage, or transfer of radioactive material (RAM) or equipment using such materials. The scope of RAM addressed by this chapter includes the following: radioactive sources and materials covered by United States Nuclear Regulatory Commission (NRC) licenses (general, specific-scope, etc.), radioactive sources and materials not regulated by the NRC, and radioactive waste. Terms and acronyms used in this chapter are defined in Appendix A.

C-12.2.1 Radiation Protection for Radiation-Generating Equipment. OHPM Chapter 9 The contractor shall comply with policies, procedures, and radiation protection requirements for the procurement and use of radiation-generating equipment (RGE), which includes, but is not limited to, x-ray-producing equipment. RGE produces ionizing radiation without the use of radioactive material (i.e., nuclear sources).

C-12.2.2 Non-ionizing Radiation. OHPM 10 The contractor shall comply with requirements of GRC's policy is to ensure that non-ionizing radiation sources are identified, work areas are posted (if needed), users are properly trained to work with and around these sources, measurements are taken (if needed) to evaluate worker exposures, and controls to mitigate hazards are implemented, as needed, when surveys indicate that exposures can exceed acceptable limits.

C-12.21 Bloodborne Pathogens. OHPM Chapter 11- The contractor shall comply with OSHA and GRC Bloodborne Pathogens requirements for all employees who have occupational exposure to blood or other potentially infectious materials (OPIMs) of human origin. Occupational exposure is defined as reasonably anticipated skin, eye, mucous membrane, or other parenteral contact with blood or OPIM that

may result from the performance of the employee's duties. Note that bloodborne pathogen regulations do not apply to "Good Samaritan" acts performed on a voluntary basis in an emergency situation.

C-12.22 Indoor Environmental Quality. OHPM Chapter 12- The Contractor shall comply with the requirements of the GRC policy for indoor environmental quality including the GRC Smoking Policy.

C12.23 Laser Safety: OHPM Chapter 13. The contractor shall comply with requirements set forth in the Laser Safety Chapter and participate in the required review and evaluation processes for potential hazards associated with such lasers or laser systems is via the Center's safety permit process and construction health and safety plan review process.

C-12.24 Acquisition of Hazardous Chemicals and materials. OHPM Chapter 14 The contractor shall conform to the requirements of the policy for the procurement of hazardous chemicals so as to assure the safe handling, receipt, control, and shipment of the hazardous chemicals in order to protect the requester, user, transporter, shipper, and the environment from any exposure to a hazardous chemical. Unless specifically stated otherwise in this document, acquisition of hazardous chemicals at GRC shall follow the recommendations of NASA Procedural Requirement (NPR) 1800.1 Chapter 4.7, Control of Hazardous Substances and Articles Acquisitions and the Executive Order 13423.

All chemical purchases must be pre-approved by the SHeD.

All chemicals will be bar-coded to update the GRC inventory.

The Hazard Communication Standard 29 Code of Federal Regulations (CFR) 1910.1200 requires Material Safety Data Sheets (MSDSs) with chemicals and a list of all potential chemical hazards in each area. When acquiring hazardous chemicals, an MSDS is required to purchasing the potential chemical hazard. The information is entered into the Chemical Management System to provide a list of potential chemical hazards in each area. This information is then used to generate the information needed for the Emergency Planning and Community Right-to-Know Act (EPCRA) for the Superfund Amendments and Reauthorization Act (SARA) 311 and 312 reports, as referenced in Chapter 13 of the Environmental Programs Manual (EPM). By reviewing the hazardous chemical acquisition, we are aware of the materials at GRC and can plan accordingly to address any incident.

Ergonomics OHPM Chapter 15 The contractor shall implement an Ergonomics Program to reduce risk of ergonomics related injuries.

C-12.25 Food safety. OHPM Chapter 16- The contractor shall comply with food safety practices where catered or vended food will be served or sold to NASA Employees. An inspection will be conducted the day of the event/program.

C-12.26 AED program. OHPM Chapter 18- The contractor shall conform to the specified AED training requirements for employees who volunteer to become AED responders.

C-12.27 Synthetic Inorganic Fibers OHPM Chapter 19. The contractor shall assure the safe use of SIFs, which include fiberglass, rock and slag wool, and refractory ceramic fibers (RCFs) and comply with the GRC safe practices and occupational exposure limits set forth in the Chapter- especially in regards to RCF's or any other novel high temperature insulation materials.

C-12.28 Hazard Communication: OHPM Chapter 16. The contractor will develop a HAZCOM program in accordance with OSHA that describes how they will share information with other employers, their own employees and SHeD personnel regarding Material Safety Data Sheets (MSDSs), including access to them, precautionary measures, and any labeling systems used at the workplace.

The contractor shall provide SDS copies to SHeD.

The contractors shall ensure their employees are appropriately trained to handle all hazardous chemicals in their work area and ensure all chemical information is readily available and all chemicals are properly labeled.

The contractor shall be cognizant of GRC HAZ Comm program and complete the GRC Hazard communication course within the first week of the contract start as a part of their overall training.

C-12.29 Hazard and Exposure Assessment: OHPM Chapter 21. The contractor shall be responsible for the health and safety of their employees and for hazard analyses, training, personal protective equipment (PPE), medical surveillance, and other requirements to ensure compliance with NASA policy. To determine the potential for exposure, hazard assessments are required. Where the potential for significant exposure is present and/or the need for protective equipment deemed necessary, an exposure assessment is warranted. Job hazard analyses (JHAs) or hazard assessments are needed as an integral part of assessing risk of exposure to various contaminants. Therefore, JHAs or equivalent hazard assessments are required as indicated in the Glenn Safety Manual, Chapter 33 and Chapter 15.

C.12.30 Reproductive Hazards: OHPM Chapter 22. The contractor shall be responsible for the health and safety of their employees and for hazard analyses (including reproductive hazards), to ensure compliance with NASA policy.

C-12.31 Nanomaterial Health and safety: OHPM Chapter 23. The contractor shall ensure the health and safety their employees who work with nanomaterials. Nanomaterial Users shall develop a Standard operating procedure with exposure control considerations for nanomaterial use as part of a safety permit. Users shall develop a laboratory SOP with exposure control considerations for nanomaterial use in a chemical laboratory.

C-12.32 OSHA regulated materials: OHPM Chapter 24. The contractor shall ensure the health and safety their employees who work with and use OSHA-regulated materials not covered by other Occupational Health Manual Programs chapters, such as asbestos and lead. The OSHA regulated materials list is covered in the chapter.

C-12.33 Chemical Hygiene: OHPM Chapter 25.The contractor shall ensure the health and of safety their employees who are engaged in the laboratory use of hazardous chemicals and assure Center compliance with the Occupational Safety and Health Administration (OSHA) Regulation 29 Code of Federal Regulations (CFR) 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories.

C-13 COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM (CMMS)

C-13.1. General, The Contractor shall utilize the GRC CMMS for Asset Management and Work Order processing (work order initiation, work order tracking, labor hour tracking per work order, field observation logging, etc.). Contractors can use company-owned software for purposes of inventory management, purchasing and other business functions as required.

GRC's CMMS system of record for managing Institutional (IN), Test (TS) and Central Process Systems (CP) Assets at both Lewis Field and Plum Brook Station is Maximo Asset Management Version 7.5, a product of IBM, Incorporated. GRC will provide controlled access to Maximo to the Contractor and reserves the right to upgrade the version of Maximo at any time during the life of this contract. Since the Maximo software used by GRC has been customized from the vendor's standard version, local training will be provided to the Contractor's personnel by the Government at no additional cost to the Contractor.

Whenever the term CMMS is used in this SOW, it refers to GRC's Maximo software. The Contractor is prohibited from using an electronic interface between any other CMMS system (including an external Maximo system) and the GRC Maximo system for purposes of Asset Management and Work Order processing.

All of the Operations & Maintenance Contractors at both GRC Lewis Field and Plumb Brook Station (four independent contracts) utilize a single installation of Maximo for Asset Management and Work Order processing. All of the IN, TS, CP and PS Assets are loaded into this single installation of Maximo.

GRC's system of record for Pressure Systems (PS) Assets at both Lewis Field and Plum Brook Station is the Pressure Systems Database (PSD), which is a customized Oracle database. The Government has created various interfaces between the PSD and Maximo Systems for purposes of generating Work Orders which will be identified later in this chapter.

Both GRC Operations and Maintenance personnel and Contractor personnel have responsibilities to enter data into the GRC Maximo and PSD systems and to monitor trends and produce reports. This chapter will clearly describe the Contractor's Maximo responsibilities for various types of work. In addition, this chapter describes the current configuration and the established processes and procedures used for the GRC Maximo and PSD Systems. This description is not meant to restrict future innovations that may be recommended by the Contractor. The Government understands that the current configuration may not be optimal, and following award, the Contractor is encouraged to recommend changes and modifications. As indicated above, other maintenance contractors at GRC are also using the Maximo System, so any modifications and changes must be analyzed and tested to ensure that others are not adversely impacted.

C-13.2 GRC Maximo Definitions, Processes & Module Information. Basic definitions and terminology for the GRC Maximo System are listed in Attachment J-C-13.2a. Maximo process flowcharts are provided in Attachment J-C-13.2b. The GRC Maximo System Module Information & Status is provided in Attachment J-C-13.2c.

C-13.3 GRC Maximo Security Group and Work Group Structures. A selected number of Contractor employees will be furnished with an ACES computer seat and a NDC domain account. Anyone at GRC with an NDC account can initiate a Work Request in Maximo without having a Maximo seat license. However, a seat license is required to view, add or change data within the Maximo System.

At GRC, there is a Maximo Security Group and a Work Group Structure that establishes what Maximo users can and cannot do within the database system. By definition, a Security Group identifies which

persons can enter specific types of data into Maximo and a Work Group identifies specific crafts and limits persons as to what type of data can be viewed in Maximo.

This description of the Security and Work Group Structures below is intended to convey how the GRC Maximo System is currently configured and not intended to direct Offerors on how to structure their management organization.

C-13.3.1 Security Groups. Licensed users will be issued a Security Group classification by the GRC Maximo Administrator in accordance with their job responsibilities. The Security Group assigned will dictate if the user is add or change data, or if the user is limited to "read only" capabilities. Established Security Groups are listed in Attachment J-C-13.3.1. Currently, there are seven (7) Security Groups reserved for Government employees, and five (5) Security Groups available to Contractor personnel. Those available to Contractor personnel are Functional Area Mangers, Read-Only Guests, Work Controllers/Schedulers, Work Group Leads, and Work Group Technicians. In certain instances, the Security Group Functional Area Administrator can also be issued to a Contractor employee.

C-13.3.2 Work Groups. For the GRC Maximo system, there are fifteen (15) Institutional Work Groups as listed in Attachment J-C-13.3.2. Three (3) Work Groups are reserved for Government employees, and twelve (12) Work Groups may be assigned to Contractor personnel.

Each Work Group assigned to the Contractor shall have a Work Group Lead (although a single individual may be assigned to multiple Work Groups). The Lead will have the ability to view, add, or change data only for Work Orders assigned to their Work Group. In addition, each Work Group assigned to the Contractor shall have Work Group Technicians. The Technician will only be able to view, add, or change data only for Work Orders to which they are assigned. If other Work Groups are required, the Contractor shall contact the GRC Maximo Administrator.

C-13.4 Mobile Technology. The GRC Maximo system is located within the Center's firewall and is accessible only with a NDC domain account. Although GRC has wireless IT capability throughout the Lewis Field Campus, mobile technology is currently not being utilized to support the functions required under this SOW.

Options for mobile technology are currently being evaluated by the Government. Once the Government selects a mobile solution, a plan will be established and the contract will be modified to include the testing and implementation of mobile technology. The Government will also provide training for Contractor personnel on the selected mobile solution.

C-13.5 Maximo Assets Module. Configuration control of CP and PS Assets in Maximo is the responsibility of the Government. Although the Contractor will have the capability of adding/decommissioning assets and modifying asset information, the Contractor shall not perform these functions without obtaining approval from the Government POC.

C-13.5.1 Maximo and PSD Asset Inventory. The Contractor shall partner with the Government to manage the CP and PS Asset inventory in Maximo and the PSD. This shall be accomplished through the field verification of Assets during standard PM/PGM/PT&I cycles, repairs, or IDIQ tasks to capture any anomalies or omissions. Upon approval by the Government, the Contractor shall update the Maximo Assets Module to reflect any findings.

C-13.5.2 Assets Installed by Other Contractors. New system construction and major rehabilitation of existing Central Process Systems or Pressurized Vessels and Systems is often accomplished through independent construction contracts (not under the scope of this contract). In most cases, these projects install new or decommission existing CP and PS Assets. As part of

the scope of work, the construction contractor is required to provide Asset information to a Government POC for input into Maximo.

At a point between 60 and 70% construction completion, an IDIQ task will be generated to this contract requesting that the Contractor walk the site with the Government POC and physically tag all newly installed Assets.

C-13.5.3 New Assets Installed/Removed Under This Contract. If the Contractor installs new Assets or removes existing Assets as part of this contract, the following information shall be provided to the Government POC in an electronic format for approval prior to uploading into Maximo. The GRC Maximo Administrator will provide a Microsoft EXCEL template for the Contractor's use to capture the following data:

- Description of Asset
- Manufacturer
- Vendor information
- Model Number
- Serial Number (must be verified by Contractor Personnel upon delivery)
- Acquired date
- Installed date
- Purchase price (equipment cost)
- Operating status (operating, not ready, or decommissioned)
- Asset Classification Code
- Location of Asset (building number, floor, room)
- Digital picture (JPEG, etc.) of Asset in its installed location
- Scanned information such as O&M manual, parts lists, and consumables (PDF or JPEG)
- Reference drawing numbers (if applicable)
- NASA Condition Code (numerical value from 1 to 5)
- Warranty information (if applicable)

The Contractor will receive an official Asset number and tag from the Government POC and shall be responsible for installing the tag in a visible location on the Asset. For assets associated with the GRC Pressurized Vessels and Systems, the Contractor will receive a Pressure Systems Database (PSD) system code from the Government POC.

The Contractor shall provide a semi-annual report of all new assets that they install and any existing assets that they decommission under this contract.

C-13.6 Maximo Work Order Module, PM/PGM/PT&I Work for CP Assets. The GRC Maximo System is currently loaded with PM/PGM/PT&I job plans and frequencies for CP and Assets. Changes and alterations to job plans and frequencies must be approved by of the Government's Institutional Systems Mangers and the Pressure Systems Officer. The Contractor shall collaborate with the Systems Managers to establish an optimal preventative maintenance program, and upon formal approval from the Government, make the changes in Maximo accordingly.

At GRC, a PM/PGM/PT&I can be assigned to an Asset (specific piece of equipment), a Location (such as a building identifier), or a Route (when numerous assets are bundled together). PMs for CPS Assets are generated directly by the GRC Maximo System. In-Service Inspections (ISI which is essentially a PM) for PS Assets are initiated by the PSD (see Section C-13.X below).

At the beginning of each month, the Contractor's Work Control Office (WCO) shall generate a Maximo report to specify which PMs for CP Assets are due for the next month (e.g., a January report would

indicate the PMs for CP Assets due in February). The WCO shall then review workload with the Government, and upon approval, generate the PM Work Orders accordingly. The Contractor shall then ensure that the appropriate outages are scheduled and parts ordered in time for the execution of the PMs the following month.

The Contractor shall follow the procedures for PM/PGM/PT&I Work on CP Assets:

C-13.6.1 **Once** the PM/PGM/PT&I Work Order is generated, the Target Start Date will be automatically populated in Maximo. By definition, the Target Start Date is the *desired* start date, but not necessarily the date that the Contractor actually started work on the task.

C-13.6.2 Once the Work Order is started and Contractor technician time is ready to be entered, the Work Group Technician shall enter the Actual Start Date under the Work Order Tab.

If the CP Asset for which the PM/PGM/PT&I activity is scheduled is not available (e.g., a research test is ongoing within a facility) and the work cannot be accomplished, the WCO shall check the "inactive" box within the PM Module. When testing is completed and the facility is available, the inactive box shall be unchecked, and the PM activities shall proceed. The WCO must review the inactive PM/PGM/PT&I activities monthly with the Government to identify areas where maintenance is stalled due to test activities.

C-13.6.3 Once the work has started, the Work Group Technician shall enter the Labor Hours (regular hours for which only eight hours can be added per day) and the Premium Pay Hours (for any approved overtime hours) under the Actuals Tab. A Feedback Form is automatically attached to the PM that includes all of this stuff….filled out manually and returned to the work group lead who enters the corrected data into Maximo. The Work Group Technician shall also populate the Work Log Tab with comments including verification of Asset bar code, assessment of task validity and frequency, safety concerns, needs for special tools or manufacturer's information, Asset data corrections, field observations, work that was accomplished, issues that occur, etc.

As mentioned above, GRC plans to implement the use of mobile technology to help facilitate the capturing of field comments at some point during this contract. In the interim, the Contractor shall ensure that field comments are captured and uploaded into Maximo.

C-13.6.4 The Work Group Technician shall either assign a Facility Condition Index (FCI) or update the FCI of the equipment being maintained (if applicable). This information is entered in the Asset Module, Asset Tab as a numerical value between 1 and 5.

C-13.6.5 **At** the completion of the work, the Work Group Technician shall change the Status Field to Work Complete for the PM/PGM/PT&I task in the Actuals Tab.

C-13.6.6 The Work Group Lead or the WCO shall enter the Actual Finish Date and change the status of the overall Work Order to Ready Close.

C-13.6.7 The COR will perform surveillance on approximately 10% of the completed PM/PGM/PT&I Work Orders, and generate an associated evaluation. If the COR determines that the work is not complete, the status will be changed to Rework, and the Work Group Lead will be notified. If the COR determines that the work is complete, the Work Order will be closed.

C-13.6.8 If equipment malfunctions or system issues are identified during the execution of a preventative maintenance activity, the Work Group Lead shall issue a Work Request in

accordance with the procedures listed below.

C-13.7 Maximo Work Order Module, OCR/MCR Work. For OCR/MCR WOs, Customers will generate a Maximo work request by either calling or e-mailing the WRO or by accessing Maximo directly through the GRC Intranet, Facilities Division Website. TCs can also be generated by the Contractor's Work Control Lead following the identification of a problem during a routine maintenance activity.

The WRO sends work to COR as "awaiting approval" (WAPPR), and COR approves and sends to Contractor's Work Control Office.

C-13.7.1 The Customer will enter the Target Finish Date.

C-13.7.2 The GRC WRO will determine if the Customer's work request is a TC, populate the Work Order Type, and change the Status to Approved. The WRO will then go to the Request Priority box and select Emergency, Urgent, or Routine from the drop-down menu. Lastly, the WRO will enter the TC financial WBS number, the FOS, the POC (Customer's name), the Work Group (LF-IN-CONT-WKCTRL), and populate the Scheduled Finish Date.

C-13.7.3 The GRC WRO will send the TC Work Order directly to the Contractor's WCO. The WCO then change the Work Group in accordance with the appropriate trade. This directs the TC to the appropriate Work Group Lead.

C-13.7.4 Upon receipt of the TC, the Contractor's Work Group Lead shall enter the Work Group Technicians assigned to the task, and the Scheduled Start Date.

C-13.7.5 Upon review of the TC and the associated field conditions, if the Work Group Lead suspects that the cost for the work will exceed the TC cost threshold (see Section C.10.4), the Work Group Lead shall halt the work and follow the procedures outlined in Section C.10.6 to transition the TC Work Order to a Repair.

C-13.7.6 If a site-specific safety plan is required for the TC, the Contractor's Safety & Health representative shall check the Job Hazard Analysis (JHA) box, and attach a WORD, PDF, or IFM version of the plan to the Work Order.

C-13.7.7 Once the Work Order is started, the Work Group Lead, under the Work Order Tab, shall enter the Actual Start Date. The Work Group Technician can enter the Actual Start Date for their assigned portion of the Work Order (not the entire Work Order).

C-13.7.8 Once the work has started, the Work Group Technician, under the Actuals Tab, shall enter the Labor Hours (regular hours for which only eight hours can be added per day) and the Premium Pay Hours (for any approved overtime hours). The Work Group Technician shall also populate the Work Log Tab with comments including verification of Asset bar code, safety concerns, needs for special tools or manufacturer's information, Asset data corrections, field observations, work that was accomplished, issues that occur, etc.

C-13.7.9 If an equipment failure is identified during the TC, under the Failure Reporting Tab, the Work Group Technician shall chose the Failure Class from the drop-down menu, a Problems and Causes from the drop-down menu, and provide a Remedy in the free-form text section in the Work Order.

C-13.7.10 The Work Group Technician shall either assign a Facility Condition Index (FCI) or update the FCI of the equipment being maintained (if applicable). This information is entered in

the Asset Module, Asset Tab as a numerical value between 1 and 5.

C-13.7.11 At the completion of the TC work, the Work Group Technician shall change the Status Field to Work Complete for their individual task in the Actuals Tab.

C-13.7.12 The Work Group Lead or the WCO shall enter the Actual Finish Date and change the status of the overall Work Order to Ready Close.

C-13.7.13 The Customer will automatically receive a notice that the TC work has been completed, and receive a survey. If the survey has not been completed after thirty (30) days, the FOS can close out the TC Work Order.

C-13.7.14 The GRC FOS will perform surveillance on approximately 10% of the completed TC Work Orders, and generate an associated evaluation. If the GRC FOS determines that the work is not complete, the status will be changed to Rework, and the Work Group Lead will be notified. If the GRC FOS determines that the work is complete, the Work Order will be closed.

C-13.8 Maximo Work Order Module, Repair, ROI, and SR Work. For repairs, ROI and SR activities, a requestor will generate a Maximo work request by either calling or e-mailing the WRO or by accessing Maximo directly through the GRC Intranet, Facilities Division Website.

The Contractor shall follow the procedures below for entering Maximo data for repair, ROI, and SR work:

C-13.8.1 When the requestor generates the work request, the Reported Date is automatically populated in Maximo. The requestor will also enter the Target Start Date and the Target Finish Date.

C-13.8.2 The Government's WRO will determine the nature of the work request, and populate the Work Order Type. The requestor (or the COR) will also enter the financial WBS number and the POC (requestor's name).

C-13.8.3 All Work Orders are directed to GRC's Work Order Prioritization Meetings, which are currently held twice per week. Work Orders that receive a high priority are forwarded to appropriate COR for further action.

C-13.8.4 The COR will change the Work Order status from Waiting for Approval to Approved.

C-13.8.5 The Contractor's WCO shall change the Work Group in accordance with the appropriate trade. This directs the Work Order to the appropriate Work Group Lead.

C-13.8.6 The Work Group Lead, in conjunction with the Contractor's Business Office, shall create a cost estimate for the work if required.

C-13.8.8 Once the estimate is approved and funding is obtained, the GRC COR will change the Work Order status to Approved. The GRC COR will also enter the Scheduled Start Date (which is the date funding is received) and the Scheduled Finish Date. The GRC COR, the Contractor, and the customer will negotiate the Scheduled Finish Date based on material availability and work access restrictions.

C-13.8.10 If an IDIQ task-specific safety plan is required, the Contractor's Safety & Health representative shall check the Job Hazard Analysis (JHA) box, and attach a WORD, PDF, or IFM version of the plan to the Work Order.

C-13.8.11 Once the Work Order is started, the Work Group Technician, under the Work Order Tab, shall enter the Actual Start Date.

C-13.8.12 Once the work has started, the Work Group Technician, under the Actuals Tab, shall enter the Labor Hours (regular hours for which only eight hours can be added per day) and the Premium Pay Hours (for any approved overtime hours). The Technician shall also populate the Work Log Tab with comments (see examples above).

C-13.8.13 If an equipment failure is identified, under the Failure Reporting Tab, the Work Group Technician shall chose the Failure Class from the drop-down menu, a Problems and Causes from the drop-down menu, and provide a Remedy in the free-form text section in the Work Order.

C-13.8.14 The Work Group Technician shall either assign a Facility Condition Index (FCI) or update the FCI of the equipment being maintained (if applicable).

C-13.8.15 At the completion of the work, the Work Group Technician shall change the Status Field to Work Complete for their individual task in the Actuals Tab.

C-13.8.16 The Work Group Lead or the WCO shall enter the Actual Finish Date and change the status of the overall Work Order to Ready Close.

C-13.8.17 The COR will evaluate the work to determine the completion status. If the COR determines that the work is not complete, the status will be changed to Rework, and the Work Group Lead will be notified. If the COR determines that the work is complete, the Work Order will be closed and the Requestor will generate a survey.

C-13.9 Routine Reports. The Contractor shall use Maximo to produce various maintenance reports. The type and number of reports will determined by the COR. The Contractor shall download this information from Maximo and provide this to the Government by electronic means such as EXCEL spreadsheets.

The Contractor shall ensure that all of the data fields described in the above sections are consistently and accurately populated to ensure that reporting is accurate.

C-13.10 Pressure Systems Database (PSD). For over twenty-five years, the management of Pressure Systems (PS) Assets at GRC has been accomplished using a customized database. This database has evolved with IT technology, and is currently an Oracle database that resides on a server in GRC Building No. 142.

The PSD was developed to store information on all PS Assets such as manufacturer, model number, serial number, and all engineering data required to perform a periodic pressure certification process for the component. The database was also used to keep track of the last certification date and the next required date for future certifications.

In 2011 when the GRC Maximo System was established, several decisions were made regarding legacy PSD system. First, it was decided that the PSD would continue to be used as the system of record for PS Assets, but the PS Asset data would also be stored in the Maximo Asset Module. Therefore, newly installed PS assets, removed PS assets, relocated PS assets, or changes to existing PS asset data is entered into the PSD, and a regular synchronization process would ensure that PS asset data within the Maximo System would be subsequently updated. Currently, the asset data is synchronized four (4) times per day. Following the synchronization process, an error log is generated by Maximo. The Contractor

shall monitor this log and make any corrections that are identified.

Pressure Systems activities that must be carefully tracked include In-Service Inspections (ISI) and Certifications. Much like a Program Maintenance (PGM) activity for other types of assets, ISI activities are periodic inspections of PS Assets at a frequency of greater than one year. Certifications are a repair activity required to return an asset to its original design parameters.

At the beginning of each Contract Year, the Contractor's Work Control Office (WCO) shall generate a PSD report to specify which ISI activities for PS Assets are due for the next Contract Year. The WCO shall then review workload with the Government, and upon approval, generate the ISI Work Orders accordingly (note that the ISI job plans reside in Maximo). The Contractor shall then ensure that the appropriate outages are scheduled and parts ordered in time for the execution of the ISIs the following Contract Year. If a test is ongoing within a facility, and a scheduled ISI cannot be accomplished, the ISI Work Order shall still generated by the WCO and placed "on hold" until the work can be accomplished.

If the Contractor requires modifications to the PSD (e.g., new database programming is required), the Contractor shall notify the Government, and a work order will be generated to the on-site GRC IT contractor to perform the work.

C-14 APPRENTICE PROGRAM

C-14.1. General. The Contractor shall provide an Apprenticeship program that meets the demands of the FD need for qualified Mechanics, Electricians and Electronics Technicians to augment or replace technicians leaving the various trades. Apprentice technicians shall augment and provide a feeder system to the support services that are necessary to meet the test schedules and requirements as determined by the test programs and the FD's vision. Applicants need to meet an acceptable two year associate degree prerequisite level of competency. Deviations from perquisite competency must be discussed with the COR.

C-14.2. Scope. The Apprenticeship program shall include a four year State of Ohio Certification of a completed Apprentice Program in the Mechanical, Electrical and Electronics trades. The program shall consist of four one year evaluations of expected milestones and deliverables established at the beginning of each year of the program for each trade with a sequence of progression through each year and a required approval from supervision for advancement. Apprentices not meeting established milestones, metrics and deliverables shall be evaluated immediately to determine suitability for retention in the program. The Contractor is expected to replace individuals not meeting evaluation criteria immediately. Independent of supervision and technical guidance at the completion of the Apprenticeship Program, Apprentices shall be able to provide: operations, maintenance and preventative maintenance (PM's), and a full range skills inclusive of all Systems described in this SOW.

C-14.2.1 Description of Work. Apprentices will rotate through each appropriate CROM Functional Area in 6 month cycles. Apprentices will move to a different assignment in the same Functional Area in 3 month intervals within the 6 month cycle. Apprentices will perform tasks that are assigned. Journeyperson will determine apprentice task and guide apprentices to task completion. Apprentices will use hand, power tools and diagnostic equipment to complete task.

C-14.2.1.1 CROM Functional Area CROM Functional areas include CPS, Cryogenic & High Pressure Gas Systems, High Voltage Electrical Substation Control and Pressurized Vessels & Systems (PVS) Certification

C-14.2.2. Quality Standards "Quality" shall be defined and measured for each apprentice period performed to assure apprentices stay on pace to complete the Program within the required four years.

C-14.2.3. Schedule Standards Each apprentice shall complete all scheduled requirements for the period evaluated.

C-14.2.4. Documentation Standards. Validated level of proficiency documentation showing each apprentice completing the assigned portion of the program.

C-14.3. Milestones and Deliverables

C-14.3.1. Contractor will provide documentation that demonstrates the Program meets the Ohio State Apprentice Program requirements.

C-14.3.2. Contractor will provide documentation showing a four year plan that describes the efforts to train apprentices on the various tools, equipment and systems required to provide qualified personnel on NASA Glenn's research systems.

C-14.3.3. Contractor will conduct eight six (6) month evaluations that validate acceptable apprentice

progress with management signed oversight.

C-14.3.4. Contractor will meet quarterly with the COR to ensure the Apprentice Program is meeting milestones and deliverables.

C-14.3.5. Apprentice work efforts will be tracked using the Maximo system.

C-14.3.6. Contractor will identify a process for selection/replacement of new apprentices. Contractor will replace unsuccessful or terminated apprentices immediately (Approximately in 90 days). During the replacement process the on-going efforts shall be communicated to the COR.

C-15 FINANCIAL REPORTING (533) REQUIREMENTS

C-15.1 533 Reporting. The Contractor shall submit monthly financial reports on NASA Form 533 in accordance with the instructions on the reverse side of the form, and as published in the NASA Policy Guideline NPG 9501.2, see Section J-C-15.1, "NASA Contractor Financial Management Reporting. The Contractor shall, by the 15th of each month, provide to the COR the previous month's financial 533 report. The 533 shall contain the following information in the specified format.

C-15.1.1 Major Sections

Section 1 Overall Contract Summary

Section 2. CLIN 1 Test Service Pool Summary

Subsection 1.
Overall Test Service Pool Cost Summary
Subsection 2.
CPS Operations Costs
Subsection 3.
CPS (Operations) Preventative Maintenance Costs
Subsection 4.
CRYO Operations Costs
Subsection 5.
CRYO (Operations) Preventative Maintenance Costs

Section 3. CLIN 2 Functional Cost Summary

Subsection 1.
Overall Functional Cost Summary
Subsection 2.
CPS Maintenance Costs
Subsection 3.
CPS (non-operations) Preventative Maintenance
Subsection 3.
PSO (Office) Costs
Subsection 4.
PSO In-Service Inspection Costs
Subsection 5.
PSO Preventative Maintenance Costs

Section 4. CLIN 4 IDIQ Cost Summary

Subsection 1.
Overall IDIQ Cost Summary
Subsection 2.
Individual IDIQ Job Costs

Section 5. CLIN 5 CoF IDIQ Cost Summary

Subsection 1.
Individual CoF IDIQ Job Costs

C-16. REPORTS AND DELIVERABLES

C-16.1 Technical Reports. A summary of all technical reports, schedules, and other documents that the Contractor shall submit to the COR is provided below. This list is an addition to any administrative reports otherwise specified in the contract.

Approval: An (A) indicates that the data is furnished for approval by the Government

Review: An (R) indicates that the data is furnished for review by the Government.

Title	SOW Reference	A/R	Due Date (Calendar Days)
Overall written assessment of the CMMS	7.3.2	R	Within 30 days of Contract Start Date
CMMS Task Completion	7.3.2	R	7 Days after Task Completion
Annual Maintenance Shutdown Work Schedule Minor Maintenance Shutdowns	4.2.2	A	60 Days before the beginning of the Annual Maintenance Shutdown 15 days prior to beginning of minor shutdowns
Daily Run Report	8.1.5.1	R	Daily
Annual Update of CP-DCS Operations Procedures & Check Sheets	8.1.8	R	As Required
Condition Based Monitoring	8.2.5.2	R	Monthly
Monthly PM Work Schedule	8.1.14.2	R	Monthly, 20th of each month
Service Agreement	8.3	A	As Required and January 15th of every contract year
Site specific HASP IDIQ Tasks	8.4.1.6	A	As Required
Implementation Request Cost Estimates	8.4.1.7	A	10 Working Days after Contractor receipt of the IR
Implementation Request Completion Report	8.4.5.2	R	As Specified in IDIQ SOW
Red Line Drawing Updates	7.13.1, 8.4.3	A	As Required
Training Records	8.4.6.1	R	As Requested
Contractor Qualifications	7.2.4	R	As Requested
Critical Personnel Listing for Emergencies	7.2.3	R	3 Days after Contract Start Date, then as needed
Training Plan	7.2.6	R	Semi-Annual or as Required
Technical Reference Library	7.13	R	As Requested

Title	SOW Reference	A/R	Due Date (Calendar Days)
Status			
Quality Control Procedures	7.6	A	30 Days after Award Date
Health & Safety Plan	7.8.2	A	30 Days after Contract Award Date
Qualified LO/TO Personnel Roles and Responsibilities	12.12.1	R	15 Days after Contract Start Date, then as Requested
System Outages Notification/Area Clearance Requests	12.15	A	As Required
Safety Permit Renewal Documentation	8.1.13	A	As Required
Financial Reports	14	A	Monthly (by the 15th of each month)
Technical Progress Meetings (OCR/MCR, IDIQ, Prioritization)	7.11	R	Monthly
Joint Inventory Listing (includes facilities, equipment, tools and materials)	5.2	R	30 Days after Contract Start Date
General Inventory Exception Report	5.3	R	Once a Month
Critical Spare Parts Inventory Report	5.3.1	R	15 Day after Contract Start Date then Quarterly by the 15th of September, December, March & June
Risk Management Plan	7.5. 11.3.3.6	A	As Required
Final Drawings	4.5.2	A	As Specified in SOW

C-17 ACRONYMS AND DESCRIPTION

Name	Description
A	Annual – Services performed once during each 12-month period of the contract at intervals of 335 to 395 days.
ABS	Absolute
ACM	Asbestos Containing Material
AEF	Atmospheric Exhaust Fan
AFP	Authorized Field Personnel (AFP)
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineer
AWS	Annual Work Schedule
BA	Biennial – Services performed six (6) times each 12-month period of the contract intervals of 58 to 63 days.
BRC	Bridge Controller
BW	Biweekly – Services performed 26 times during each 12- month period of the contract at intervals of 13 to 15 days
CADS	Central Air Distribution System
CADPS	Central Air Distribution Piping System
CAEB	Central Air Equipment Building
CAM	Contractor Acquired Materials
CCB	Central Control Building
CCC	Compressor Controls Corporation
CCD	Configuration Control Database
CFR	Codified Federal Regulations
CMMS	Computerized Maintenance Management System
CO	Contracting Officer
CoF	Construction of Facilities
COR	Contracting Officer's Representative
CPSDC	Central Process System Distributed Control
CPSDC-DB	Central Process System Distributed Control - Database
CPS	Central Process System
CROM	Central-Process Recertification, Operation and Maintenance
CT	Cooling Towers
CTW	Cooling Tower Water
D	Daily – Services performed 261 times during each 12-month period of the contract, once each day, Monday through Friday, including holidays unless otherwise noted
DBF	Data Base File
DCS	Distributive Control System
DEC	Digital Equipment Corporation
DOS	Disk Operating System
ED	Electrical Dispatcher
EDM	Engineering Data Manager

Name	Description
EPA	Environmental Protection Agency
EPL	Electric Propulsion Laboratory
ERB	Engine Research Building
EWS	Engineering Workstation
FAR	Federal Acquisition Regulations
FCO	Field Console Operator (FCO)
FCR	Facility Change Request
FDI	Foreign Device Interface
FEO	Field Equipment Operator
FLSA	Federal Labor Standards Act
FMEA	Failure Mode and Effect Analysis
GFE	Government Furnished Equipment
GFF	Government Furnished Facilities
GFM	Government Furnished Material
GMI	Glenn Management Instructions
GRC	Glenn Research Center
I&R	Inspection and Recertification
I/O	Input/Output
IDE	Integrated Desktop Environment
IRT	Icing Research Tunnel
ISI	In-Service Inspections
IT	Information Technology
LAN	Local Area Network
LOTO	Lockout/Tagout
M	Monthly – Services performed 12 times during each 12-month period of the contract at intervals of 28 to 32 days.
M&R	Maintenance and Repair
MADR	Maximum Allowable Defect Rate
MAXIMO	Current CMMS database program used at GRC
MODP	Mechanical Operator Duplex Panel
NASA	National Aeronautics and Space Administration
NEC	National Electric Code
NEMS	NASA Equipment Management System
NHB	NASA Handbook
NIS/NPM	Network Internet Slaves/Network Processing Modules
NPD	NASA Policy Directive
OCMR	Operation Corrective Maintenance and Repair
ODM	Open Data Manager
OIS	Operator Interface Station
OSHA	Occupational Safety and Health Administration
PBS	Plum Brook Station

Name	Description
PCU	Process Control Units
PGM	Program Maintenance
PID	Proportional Integral Derivative
PLC	Programmable Logic Controllers
PM	Preventative Maintenance
PPE	Personal Protective Equipment
PRS	Performance Requirements Summary
PSD	Pressure Systems Database
PSPV	Pressure Systems and Pressure Vessels
PT&I	Predictive Testing and Inspections
PWS	Performance Work Statement
Q	Quarterly – Services performed four (4) times during each 12-month period of the contract at intervals of 80 to 100 days.
QA	Quality Assurance
QAE	Quality Assurance Evaluator
QASP	Quality Assurance Surveillance Program
QC	Quality Control
RCM	Reliability Centered Maintenance
RFP	Request for Proposal
RTF	Run-to-Failure
SA	Semi-annual – Services performed twice during each 12-month period of the contract at intervals of 160 to 200 days
SAC	Service Air Compressor
SAD	Service Air Drier
SCCB	Software Configuration Control Board
SCO	Senior Console Operator
SDB	System Data Books
SLDG	Software Logging Database Graphics
SMACS	Synchronized Motor Auxiliary Control System
SOW	Statement of Work
SSA	Source Selection Authority
SSR	Special Service Request
SW	Scheduled Work
TD	Trane Dehydrator
TIN	Taxpayer Identification Number
TRL	Technical Research Library
UPS	Uninterruptible Power Supply
VF	Variable Frequency
VMS	Virtual Memory System
W	Weekly – Services performed 52 times during each 12-month period of the contract at intervals of 6 to 8 days

Name	Description
WDPF	Westinghouse Distributive Processing Family
WWS	Weekly Work Schedule
100 HRS	PM to be performed every 100 hours of operations
300 HRS	PM to be performed every 300 hours of operations

[END OF SECTION]